1. Automotive Electrical and Electronics Lab Protocol

Objectives and outcomes

Course Objectives

- Study and demonstrate different electrical and electronic systems in a vehicle
- Test and analyse automotive battery, starting, charging and ignition systems
- Calibrate automotive sensors for measurement
- Interface automotive sensors with ADC

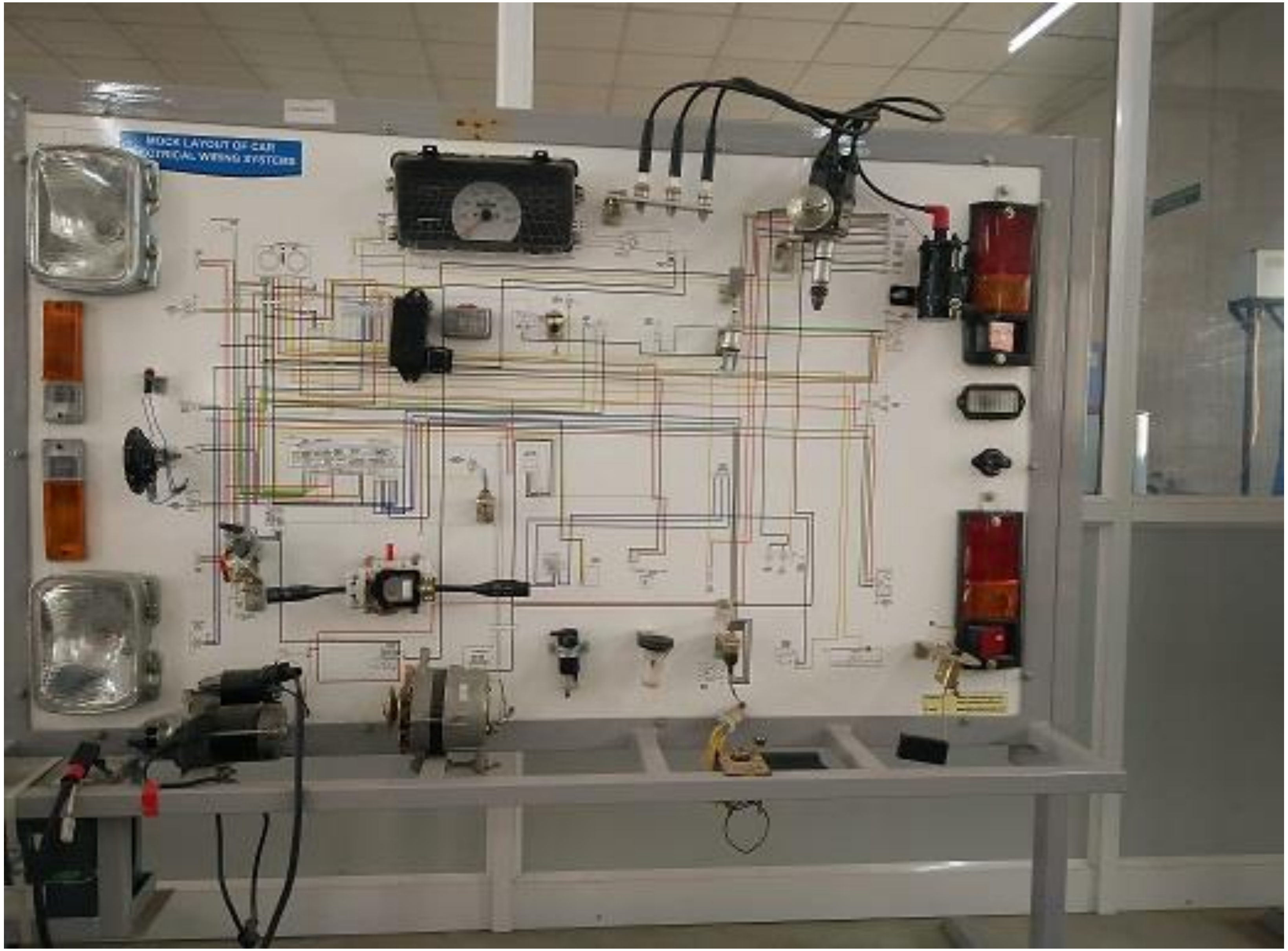
Course Outcomes

- After completion of the course the student is able to
- CO-1: Demonstration different electrical and electronic systems in a vehicle
- CO-2: Test automotive battery, starting, charging and ignition systems
- CO-3: Calibrate and use automotive sensors for measurement
- CO-4: Interface automotive sensors with ADC

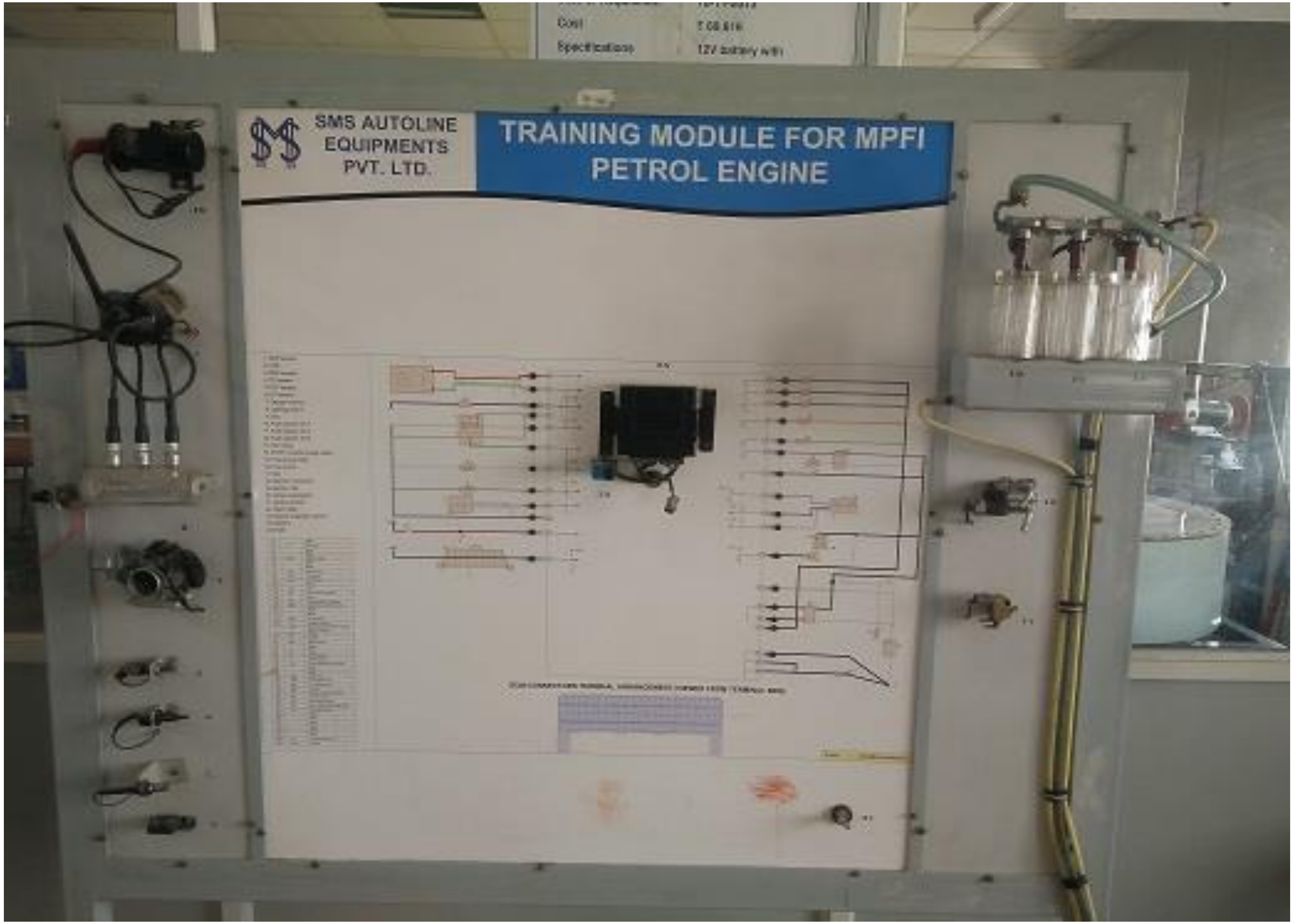
List of experiments

1. Study and demonstration of automobile electrical wiring system
2. Study and demonstration of electronic fuel injection system
3. Battery charging and maintenance
4. Starting motor and alternator testing
5. Diagnosis of ignition system
6. Temperature measurement and interfacing RTD with ADC
7. Temperature measurement and interfacing thermistor with ADC
8. Displacement measurement and interfacing LVDT with ADC
9. Load measurement and interfacing load cell with ADC
10. Pressure measurement and interfacing with ADC
11. Testing and control of DC motor

Study and demonstration of automobile electrical wiring system



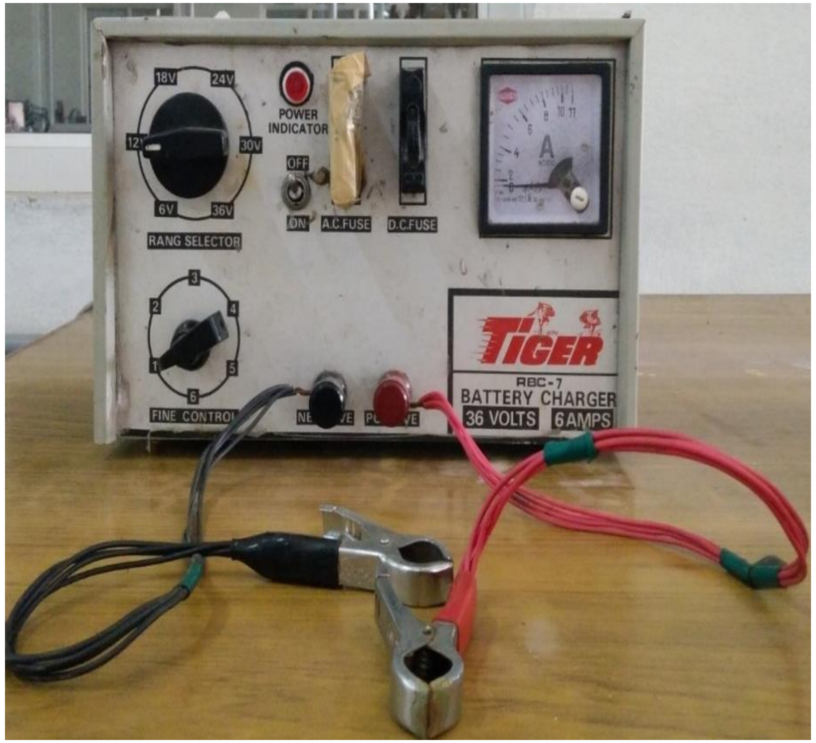
Study and demonstration of electronic fuel injection system



Battery charging and maintenance

A battery charger is intended to be connected to a battery. To recharge a fuel vehicle's starter battery, where a modular charger is used and to recharge an electric vehicle (EV) battery pack

Automotive battery tester is used to check the battery of an automobile in live conditions. It can test cranking and cold cranking conditions while being connected to the vehicle. Total life of the batter, complete analysis and health of the battery.

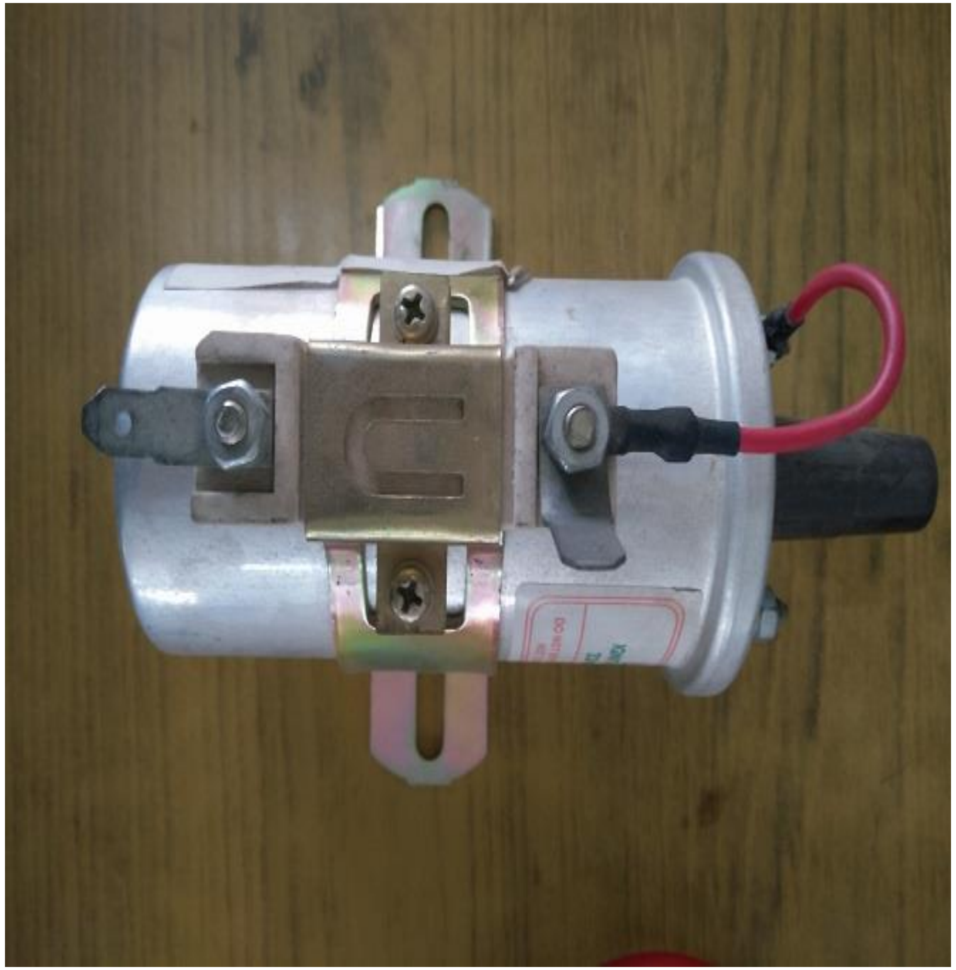


Starting motor and alternator testing

Auto electrical test bench is a table model and has been designed to cater to the needs of auto electrician, garages, service centres, transport corporation institution and other bulk users of auto electrical equipment for complete testing of alternator, regulator and their associated parts. It has also built-in dc power supply to check light run of starter motor and alternator

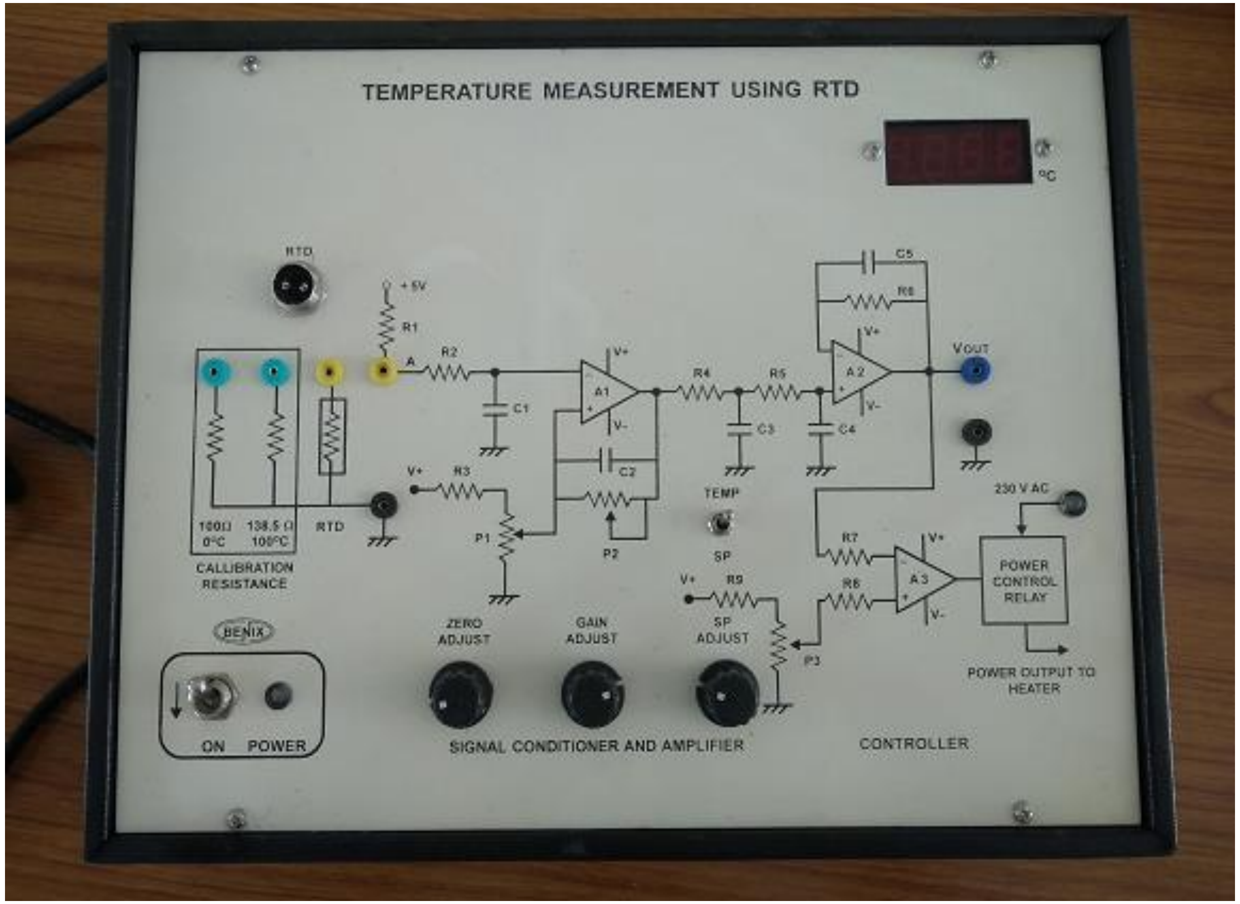
Diagnosis of ignition system

Spark plug is a device to produce electric spark to ignite the compressed air-fuel mixture inside the cylinder. The spark plug is screwed in the top of the cylinder so that its electrodes projects in the combustion chamber.



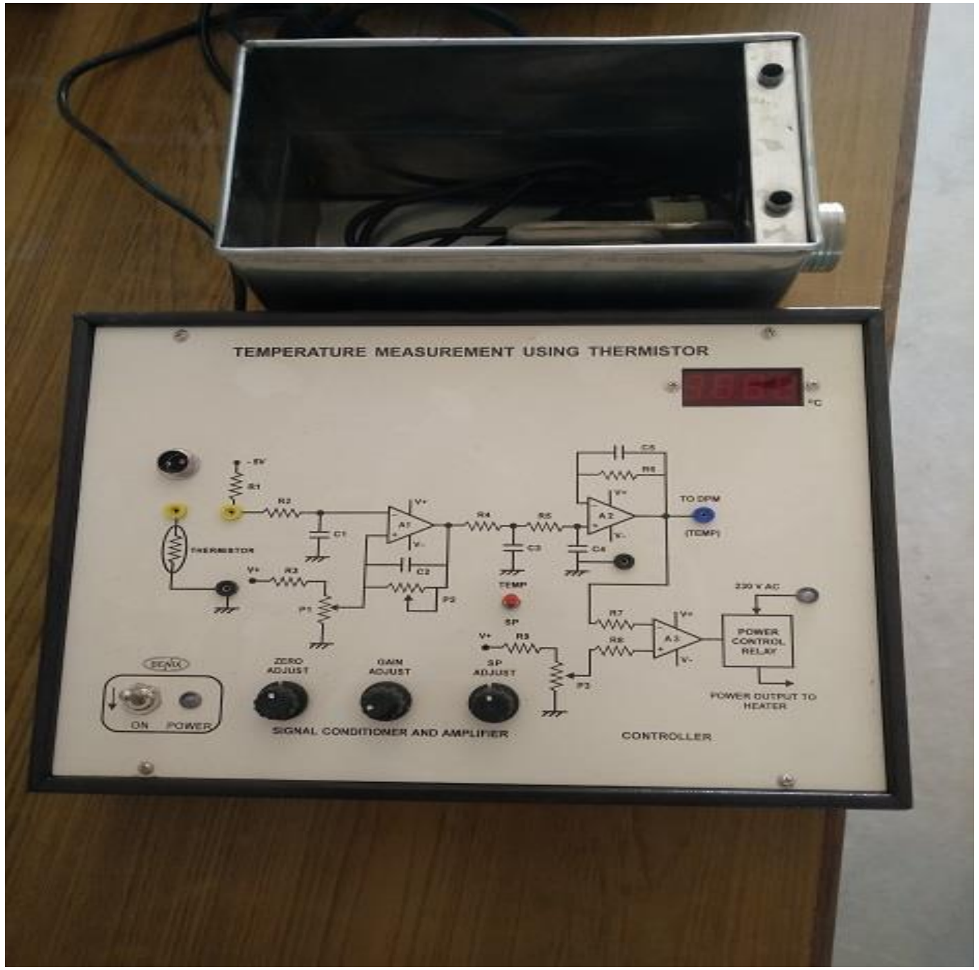
Temperature measurement and interfacing RTD with ADC

Resistance thermometers, also called **resistance temperature detectors** (**RTDs**), are sensors used to measure temperature. The RTD wire is a pure material, typically platinum, nickel, or copper. The material has an accurate resistance/temperature relationship which is used to provide an indication of temperature.



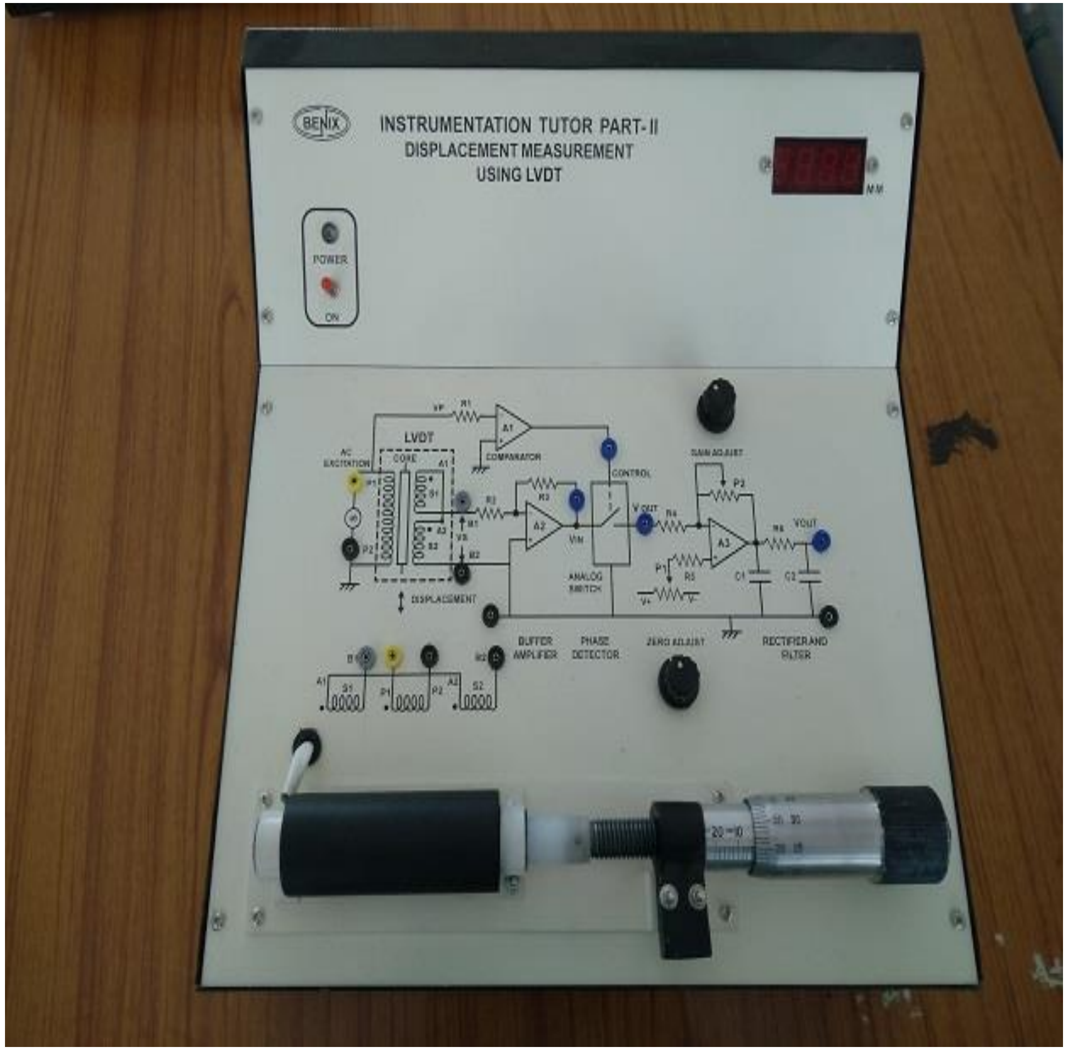
Temperature measurement and interfacing thermistor with ADC

A **thermistor** is a resistance thermometer, or a resistor whose resistance is dependent on temperature. The term is a combination of “thermal” and “resistor”. It is made of metallic oxides, pressed into a bead, disk, or cylindrical shape and then encapsulated with an impermeable material such as epoxy or glass.



Displacement measurement and interfacing LVDT with ADC

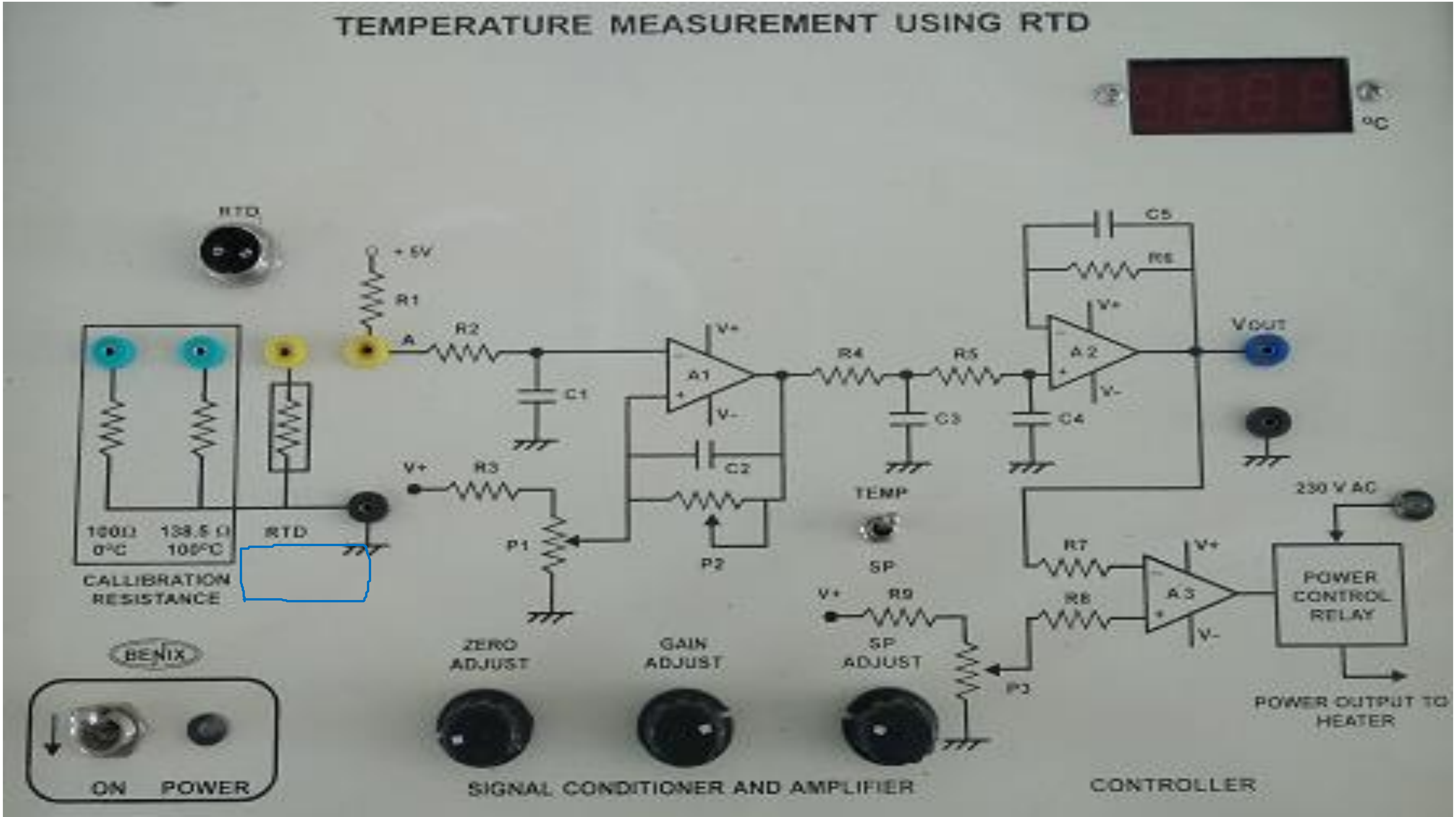
LVDT is an acronym for Linear Variable Differential Transformer. It is a common type of electromechanical transducer that can convert the rectilinear motion of an object to which it is coupled mechanically into a corresponding electrical signal.

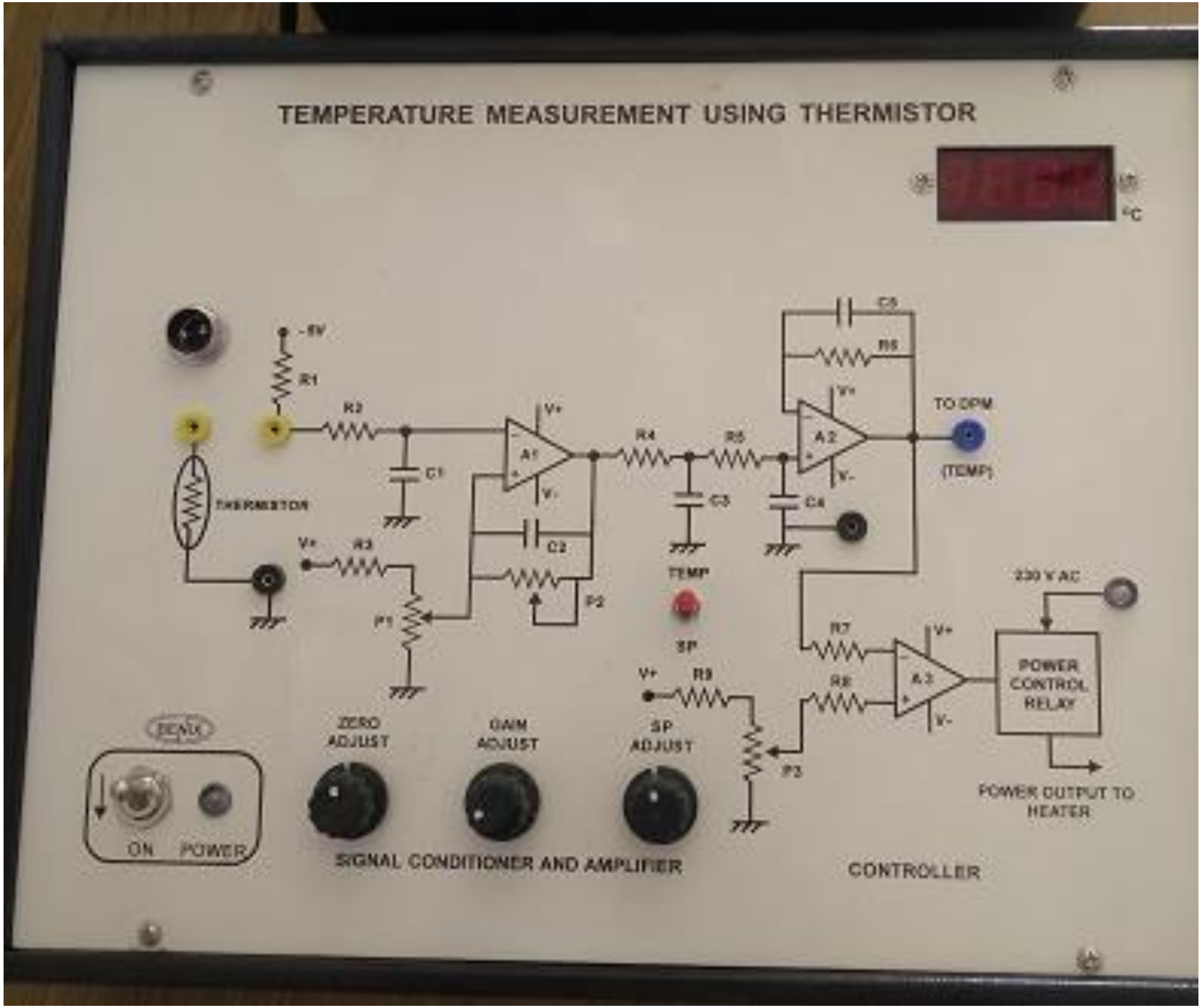


Load measurement and interfacing load cell with ADC

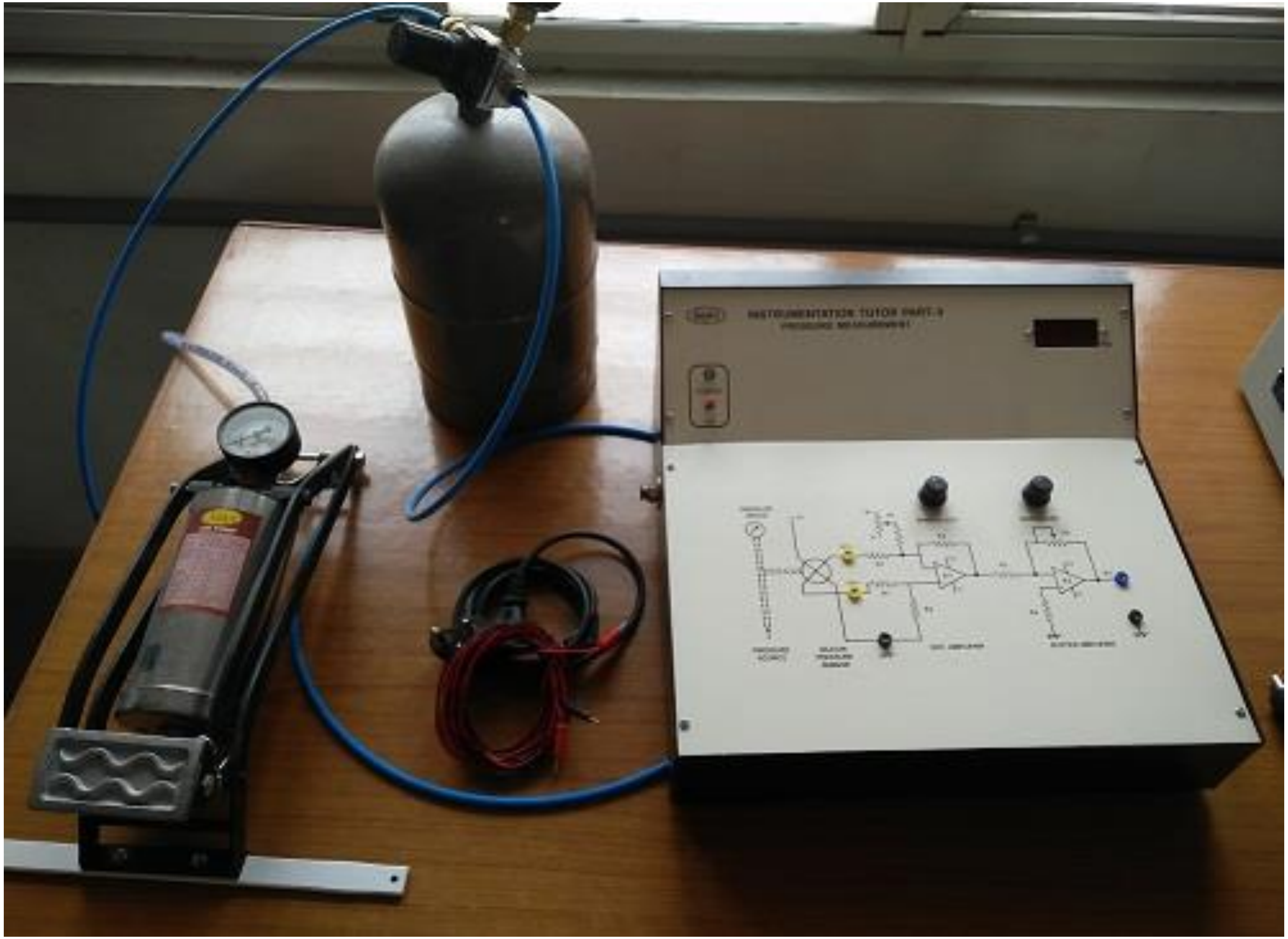
A **load cell** is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the **load cell** increases, the electrical signal changes proportionally.

Testing and control of DC motor


TEMPERATURE MEASUREMENT USING RTD
°C
RTD
+5V
R1
A
R2
C1
V+
A1
V-
C2
R3
P1
P2
R4
R5
C3
C4
C5
R6
A2
VOUT
100Ω
0°C
138.5 Ω
100°C
RTD
CALLIBRATION
RESISTANCE
TEMP
SP
V+
R9
R7
R8
A3
230 V AC
POWER
CONTROL
RELAY
P3
BENIX
ZERO
ADJUST
GAIN
ADJUST
SP
ADJUST
POWER OUTPUT TO
HEATER
ON
POWER
SIGNAL CONDITIONER AND AMPLIFIER
CONTROLLER


TEMPERATURE MEASUREMENT USING THERMISTOR
°C
-5V
R1
R2
THERMISTOR
C1
A1
V+
V-
C2
R3
P1
P2
R4
R5
C3
C4
C5
R6
A2
TO DPM
(TEMP)
TEMP
SP
R7
R8
R9
P3
A3
230 V AC
POWER CONTROL RELAY
POWER OUTPUT TO HEATER
ON
POWER
ZERO ADJUST
GAIN ADJUST
SP ADJUST
SIGNAL CONDITIONER AND AMPLIFIER
CONTROLLER

Pressure measurement using pressure transducer



2. AUTOMOTIVE CHASSIS LABORATORY

VNR Vignana Jyothi Institute of Engineering & Technology
Department of Automobile Engineering

AUTOMOTIVE CHASSIS LABORATORY

(19PC2AE01)

By

D.Suresh

Assistant Professor

Department of Automobile Engineering

VNR VJIET

suresh_d@vnrvjiet.in

91+9676541968

Course Objectives

- To identify and study of automotive chassis systems
- To distinguish functionality of various running and control systems
- To understand the troubles and remedies chassis systems

Course Outcomes

After completion of the course the student can

- Demonstrate the principle and functionality of various automotive systems
- Dismantle and assemble chassis systems
- Inspect and identify the faults in chassis systems

LIST OF EXPERIMENTS

1.Dismantling, inspection and assembling of clutch

2.Dismantling, inspection and assembling of sliding mesh gear box

3.Dismantling, inspection and assembling of constant mesh gear box

4.Dismantling, inspection and assembling of synchromesh gear box

5.Dismantling, inspection and assembling of automatic gear box

6.Dismantling, inspection and assembling of transaxle

7.Dismantling, inspection and assembling of transfer case

8.Dismantling, inspection and assembling of differential unit

9.Dismantling, inspection and assembling of brake system

10.Dismantling, inspection and assembling of suspension system

11.Dismantling, inspection and assembling of steering gear box

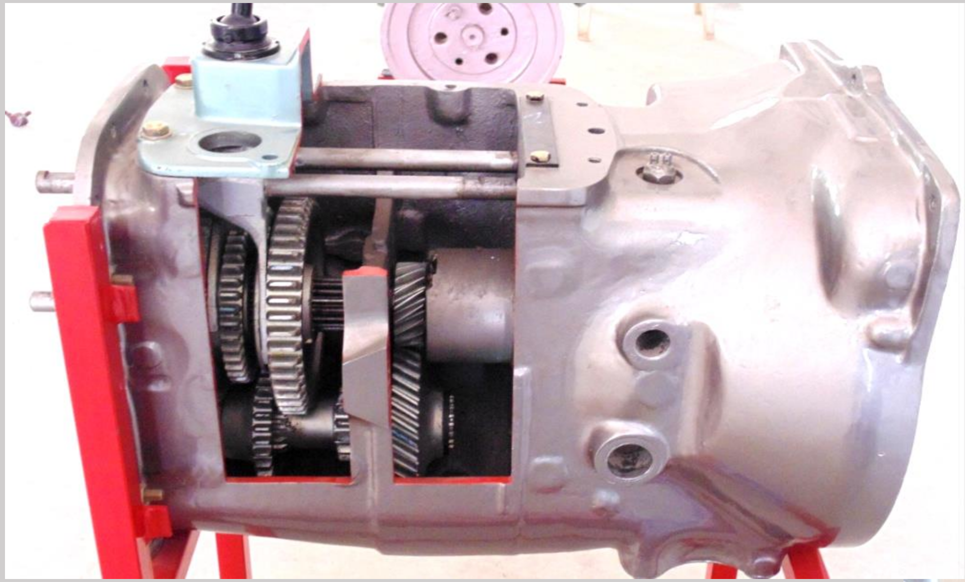
12.Dismantling, inspection and assembling of front and rear axle

Laboratory Equipment

HCV Clutch

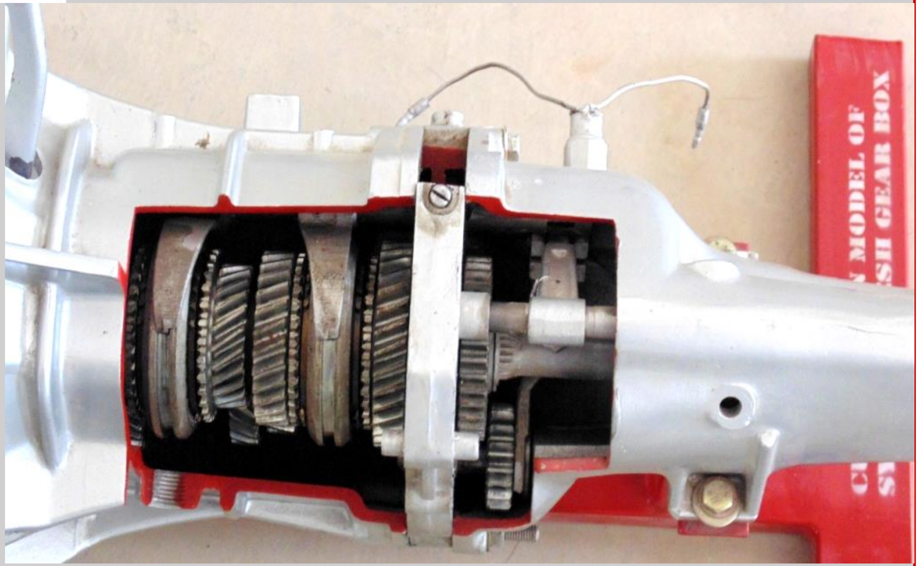
LMV Clutch

Laboratory Equipment



Sliding Mesh Gear box

Synchromesh Gear Box

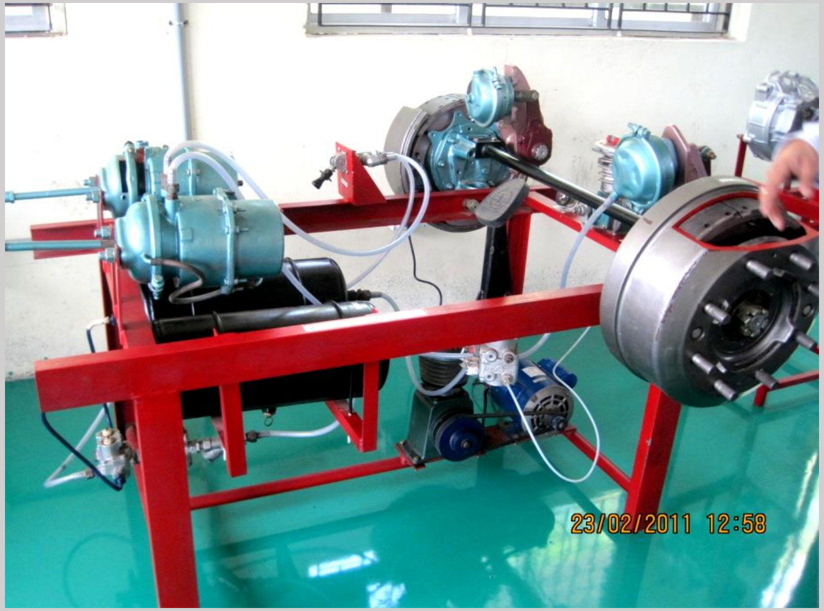


Laboratory Equipment

Automatic Gear box

Transaxle

Course Objectives



Hydraulic Braking System

Front axle with Suspension

Skills Required

- To identify suitable tool or instrument / equipment and their functions.
- Ability to handle tools and instruments
- Ability to measure different parameters and record observations.
- To interpret test results or observations during the test
- Able to make Conclusion from the Observation.

Laboratory Report

- Three members in a group
- Contribute / Perform proper role in the group to conduct experiment and to make observation
- Analyze the results together
- Each person of the group will write his/her own Discussion and Conclusion

Laboratory Report

S.No	PART NAME	QUANTITY	REMARKS

MEASURING PARAMETERS

- Thickness
- Diameters
- Gear ratio
- Design Terminology

General laboratory safety

- Maintain discipline and be regular to the laboratory
- Carry the observation book and record to the laboratory
- Follow proper dress code in the laboratory
- If you have long hair or loose clothes, make sure it is tied back or confined
- Keep the work area clear of all materials except those needed for your work
- Extra books, purses, etc. should be kept away from equipment

Course Objectives

- Check that all rotating parts are free to turn, and that there is no mechanical obstruction before operating
- If an equipment fails while being used, report it immediately to your lab assistant or in-charge
- Exercise care when working with or near hydraulically or pneumatically-driven equipment. Sudden or unexpected motion can inflict serious injury
- If leaving a lab unattended, turn off all ignition sources
- Clean up your work area before leaving
- Wash hands before leaving the lab and before eating

LAB ASSESMENT

Semester End Examination 60 M

Continues Internal Assessment 40 M

- Day to Day evaluation (10 M)
- Practical Exam (10 M)
- Team Project (10 M)
- Record (10 M)

Team Projects (2015-2019 batch)

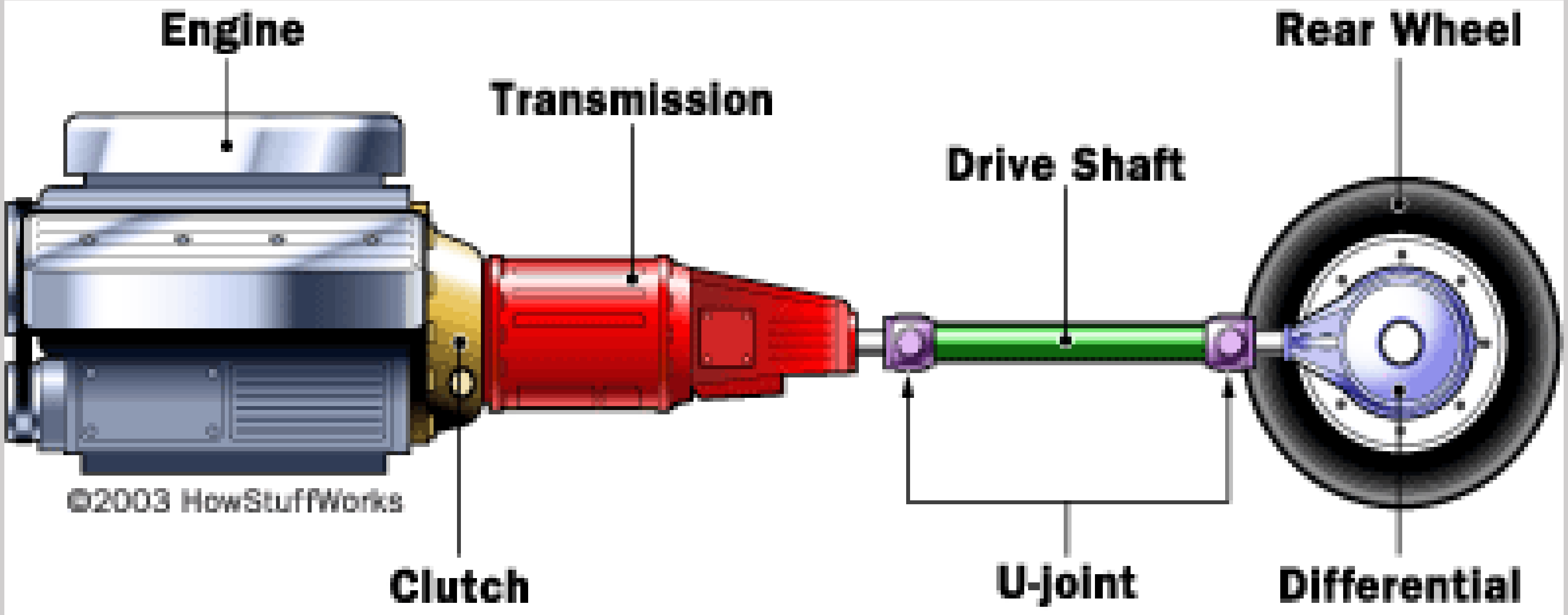
- Single plate clutch-hydraulically operated
- Multi plate clutch-mechanically operated
- Mechanically working drum brakes
- Hydraulic operated disc brake
- Double wishbone suspension system
- Telescopic shock absorber
- To prepare Rear axle assembly of Go-kart
- Motor driven constant mesh gear box

Team Projects (2016-2020 batch)

1. Pneumatic Seater
2. Power Windows
3. Modeling of Four Cylinder Crankshaft in CATIA V-5
4. Push Rod Suspension Actuation System Mechanism
5. CAD model of Brake Callipers
6. Electrically Power Assisted Steering
7. Analysis of Steering Knuckle
8. Modeling and Analysis of Differential
9. Effect of Variable Valve Lift on Performance of KTM 390

Team projects (2018-2022 batch)

1. Prepare a model of chassis
2. Prepare a LMV frame
3. Make a CVT model for scooter
4. Make an Ackerman’s steering mechanism
5. Make a Davis steering mechanism
6. Prepare a claw clutch model
7. Prepare a rear suspension model
8. Prepare brake shoe working model
9. Prepare a disc brake model


Engine
Transmission
Drive Shaft
Rear Wheel
©2003 HowStuffWorks
Clutch
U-joint
Differential

Automobile systems

Power Train

Power plant

Engine

Fuel System

Inlet System

Exhaust System

Cooling system

Lubricating

Drive line

Clutch

Gear box

Transfer case

Propeller shaft

Differential

Wheels

Running System

Suspension

Steering

Braking

Comfort System

HVAC

Seating

Audio/Video/GPS

3. AUTOMOTIVE ENGINES LABORATORY

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

AUTOMOBILE ENGINEERING

LAB PROTOCOL

AUTOMOTIVE ENGINES LABORATORY -18PC2AE02

Faculty

Dr. Shaik Amjad

Mr. GVL Prasad

What will we study in this laboratory?

Course Objectives

- To show valve and port timing diagrams
- To test performance characteristics of IC engine and compressor
- To estimate optimum cooling and heat balancing of an engine
- To perform dismantling and assembling of an engine

Course Outcomes

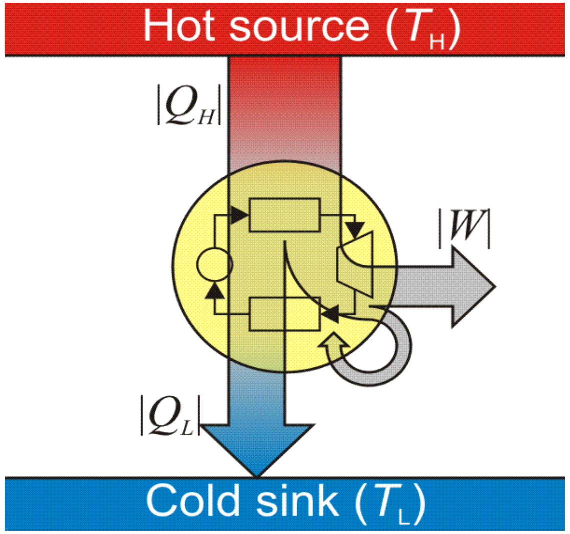
After completion of the course the student is able to

- Illustrate valve and port timing diagrams
- Analyze performance characteristics of IC engine and compressor
- Evaluate optimum cooling and heat balancing of an engine
- Demonstrate dismantling and assembling of an engine

HEAT ENGINES

Heat Engine Introduction

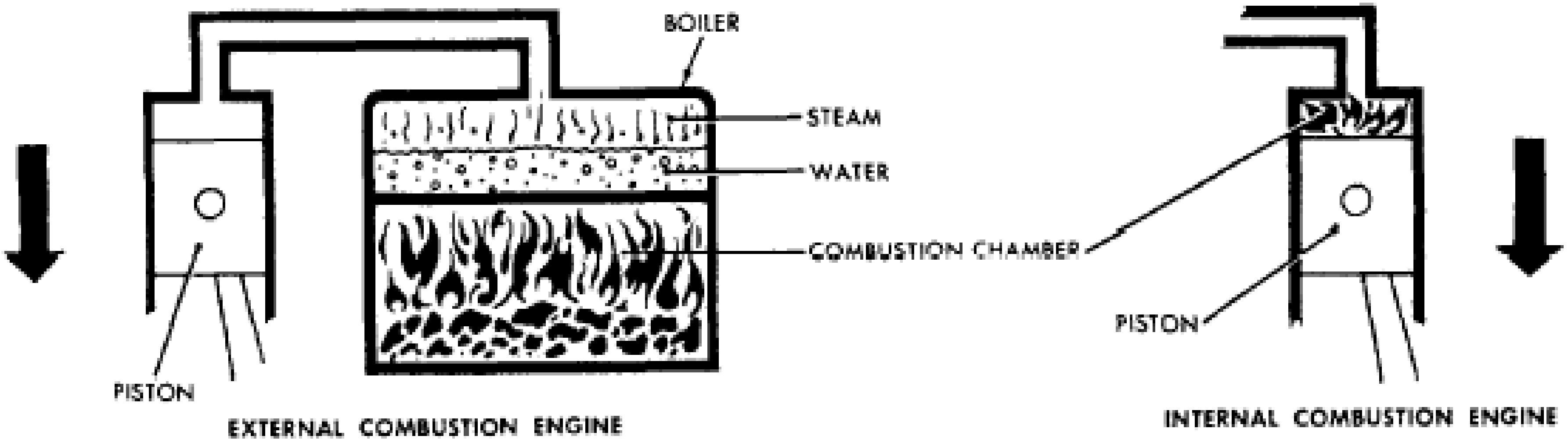
- Transforms one form of energy into another
- Heat engine converts chemical energy into thermal energy which is turned utilized to do mechanical work
- Heat engine two types :



❖ External combustion engine

❖ Internal combustion engine

❖ IC engine most widely used in automobiles



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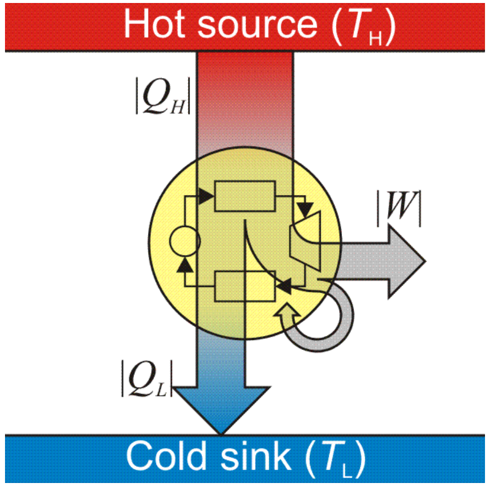
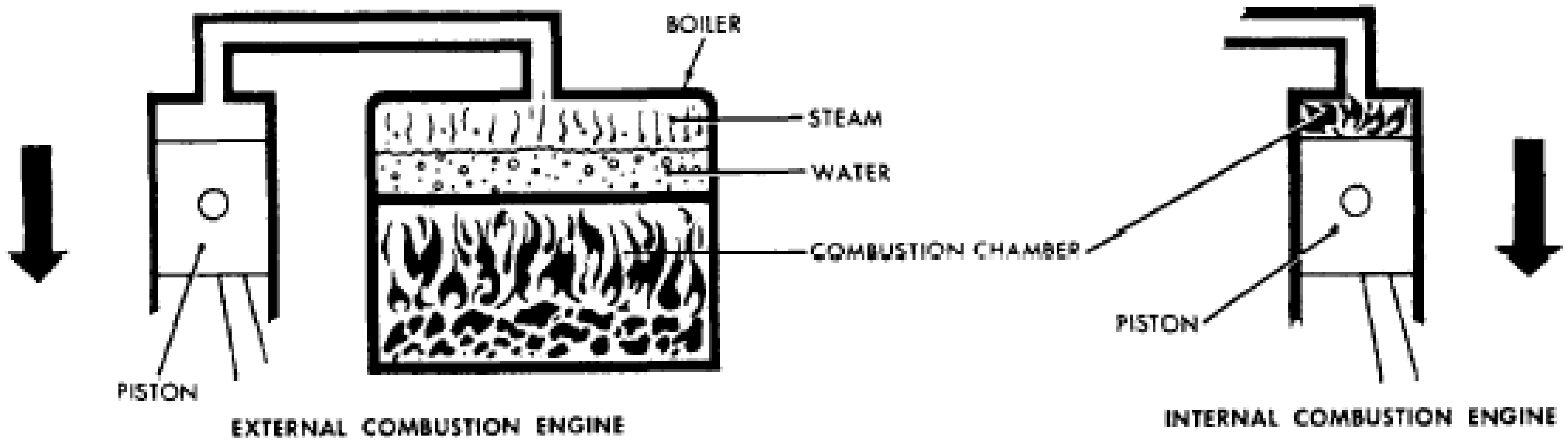
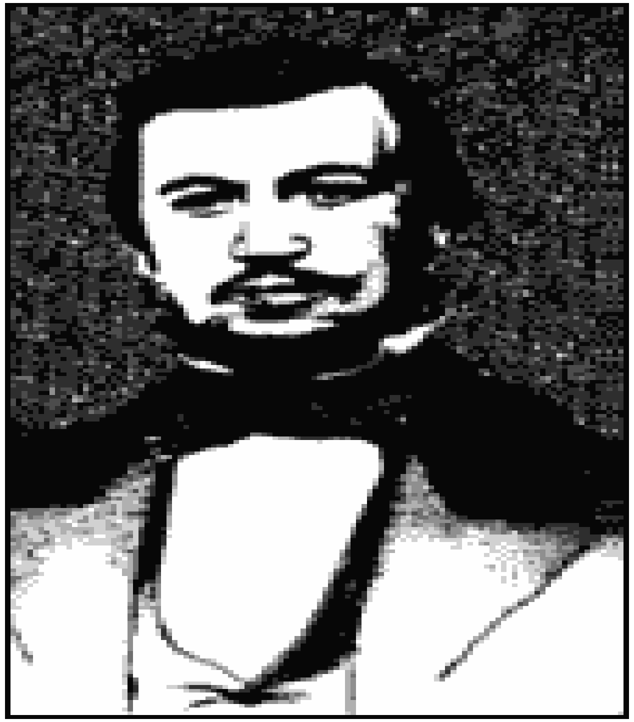




Petrol Engine



- Inventor of the four-stroke spark-ignition internal combustion engine
- In 1876 Otto built an engine in which air-fuel mixture could be compressed and ignited by a spark

Nicolaus August Otto Born June 10, 1832Died January 26, 1891 Gas-Motor Engine Patent No. 4315 Inducted 1885

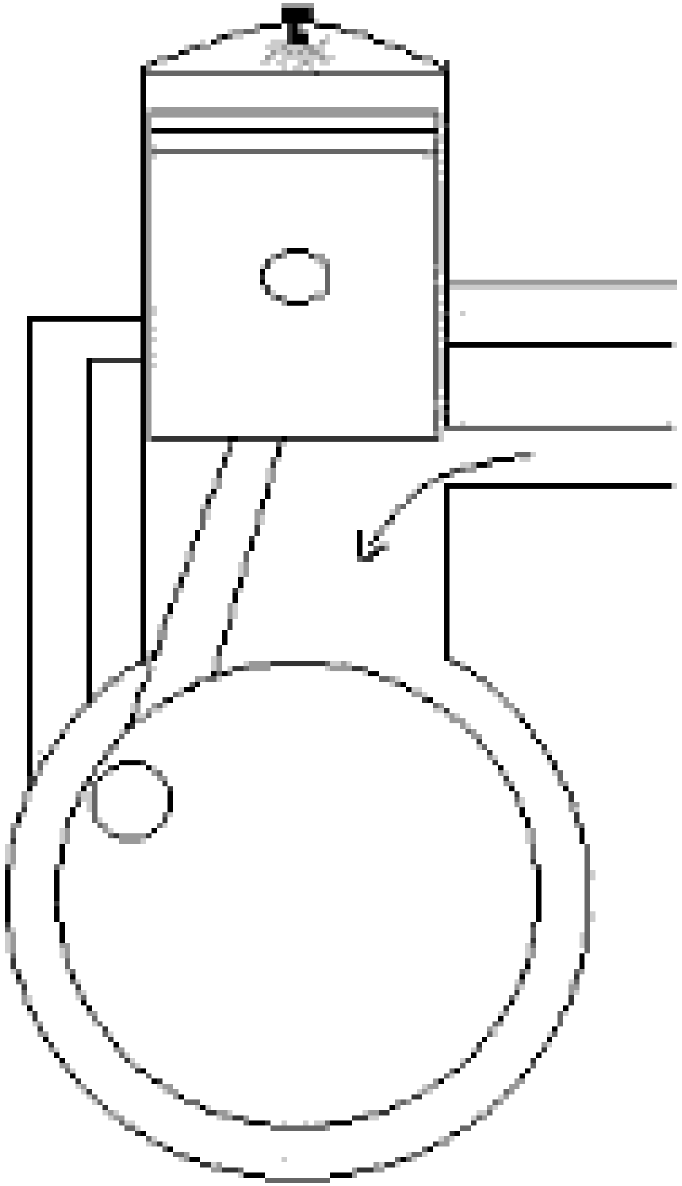
Diesel Engine

- ❖ Inventor of the four-stroke Compression-ignition internal combustion engine
- ❖ In 1893 Diesel was issued a patent for a proposed engine, in which air would be compressed so much that the temperature would far exceed the ignition temperature of the fuel
- ❖ Rudolf Diesel (1858 - 1913) Oil Engine German Patent No. 67207 Inducted 1919

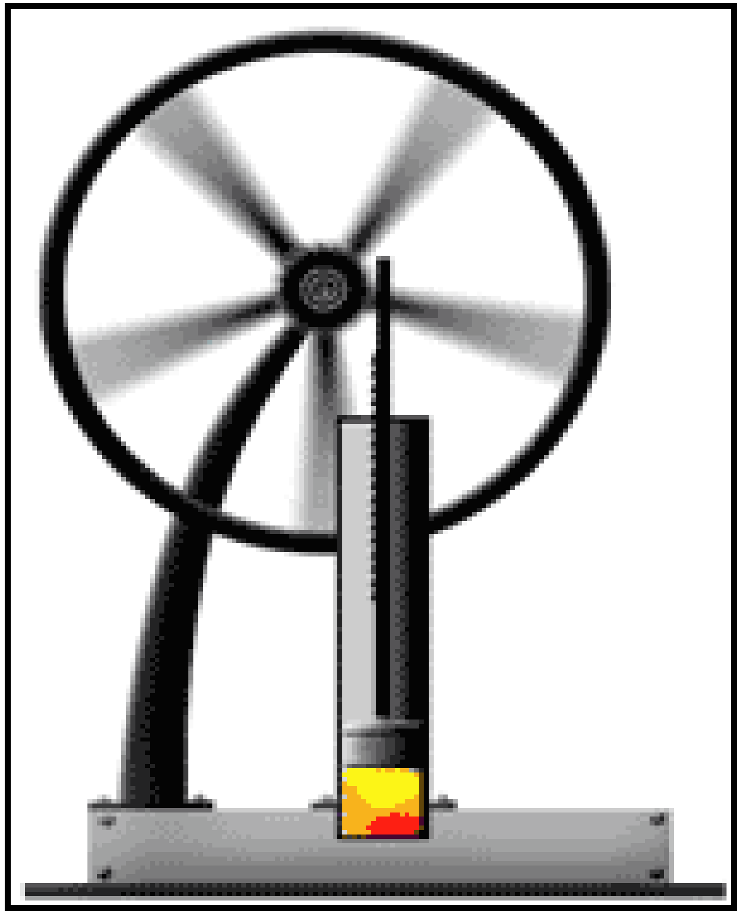
2-Stroke Engine

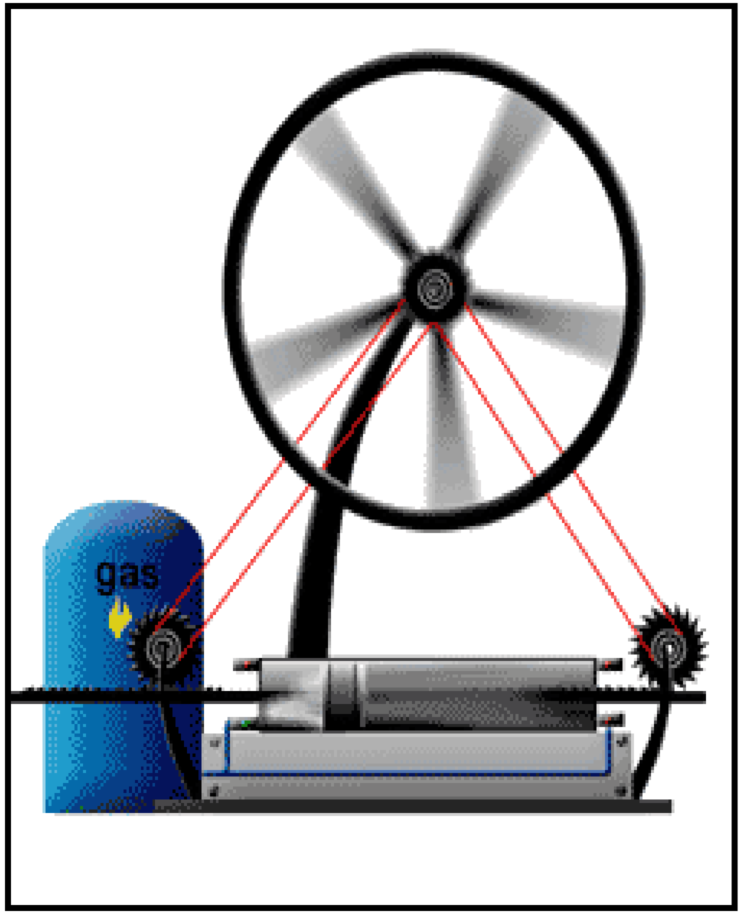
Dugald Clerk

Designed in 1878 and patented it in England in 1881.



Simplicity of Early Engines

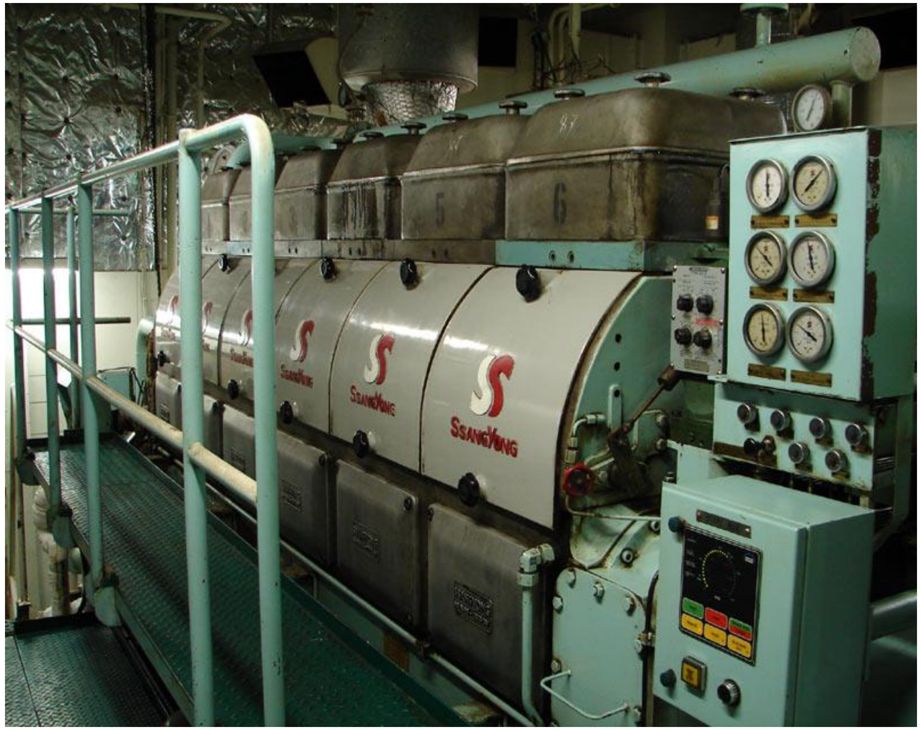


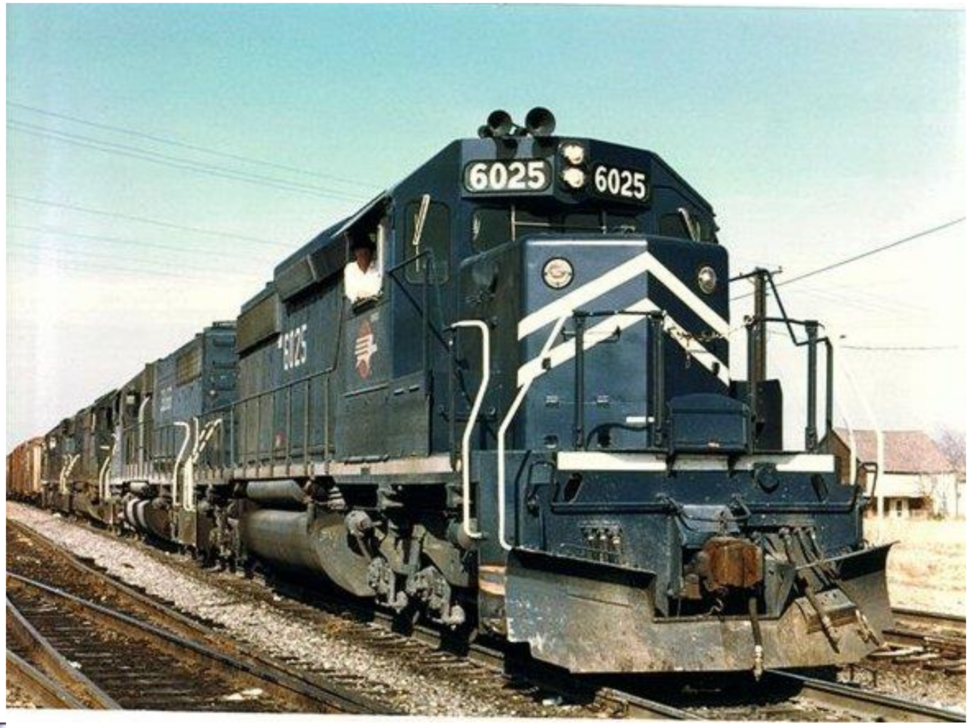


Bringing in The Real World Situation


RX100
YAMAHA
RX100
YAMAHA


USAF
U.S. AIR FORCE
FIRE
131
U.S. NAVY


SsangYong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6025
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TAMASŌMA JYOTIRGAMAYA

Thermodynamic fundamentals will be used to link the processes taking place in the engine for issues of:

- ❖ Power generation
- ❖ Fuel economy and Fuel Composition
- ❖ Effects on engine operation and
- ❖ Mechanical limitations of obtaining ideal performance

Fitting into the spectrum

- ❖As we are aware that the rate of depletion of fossil fuels is alarming
- ❖ Burning of fossil fuels causes green house effect which is harmful to all living beings
- ❖ This issue is being addressed at various forums of environmentalists and summits
- ❖ Due to above reasons, it is desirable to have higher thermal efficiencies of all IC engines.

Keywords Identified

- Valve Timing
- Port timing
- Testing
- Thermal efficiency
- Specific fuel consumption
- Mechanical Efficiency
- Brake power

Linking keywords with concepts

- IC engine
- 2-Stroke engine
- 4-Stroke engine
- S I engine
- C I engine
- Air Fuel Ratio
- Valve timing diagram
- Port timing diagram
- Performance characteristics

Generation of Exercises

- To find the valve and port timing

- To find brake thermal efficiency, indicated thermal efficiency and friction power of the engines

- To find air fuel ratio, sfc and mep of the engines.

- To find isothermal efficiency of compressor

Focusing on problem/Exercise

- ❖ Whether it is power producing device or a power consuming device

- ❖ Then decide measurements of which parameters will reflect the efficiency or performance of the engine

Design of Exercise to solve the problem

- To draw the valve and port timing diagrams
- To find the speed at which the SFC is minimum.
- To find the variation of efficiency with respective to load at constant speed.
- To find isothermal efficiency of compressor

Verification

- To compare the results obtained with standard values from the literature/manual.

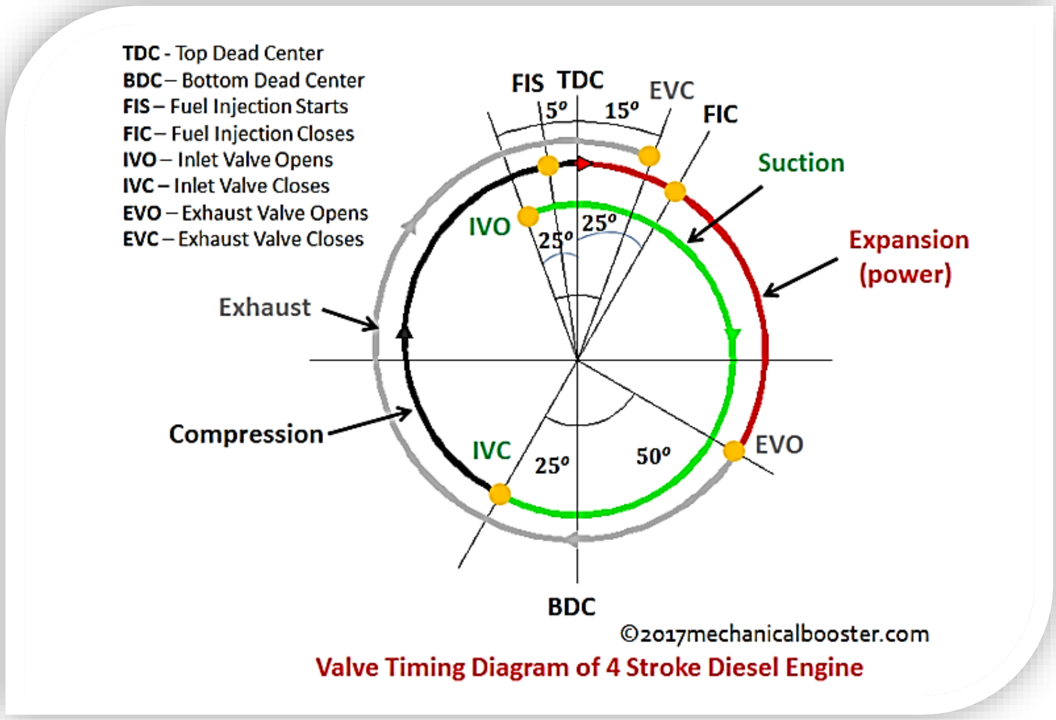
List of Experiments

1. Valve timing diagram for 4-stroke Diesel engine
2. Valve timing diagram for 4-stroke petrol engine
3. Port timing diagram for 2-stroke petrol engine
4. Performance test on 4-stroke single cylinder Diesel engine
5. Performance test on 4-stroke single cylinder petrol engine
6. Heat balance test on 4-stroke single cylinder Diesel engine
7. Morse test on multi-cylinder petrol engine
8. Optimum cooling temperature test on single cylinder Diesel engine
9. Performance evaluation on computerized Diesel engine
10. Performance test on reciprocating compressor test rig
11. Dismantling, inspection and assembling of multi-cylinder petrol engine
12. Dismantling inspection and assembling of multi-cylinder Diesel engine
13. Testing of Diesel fuel injector

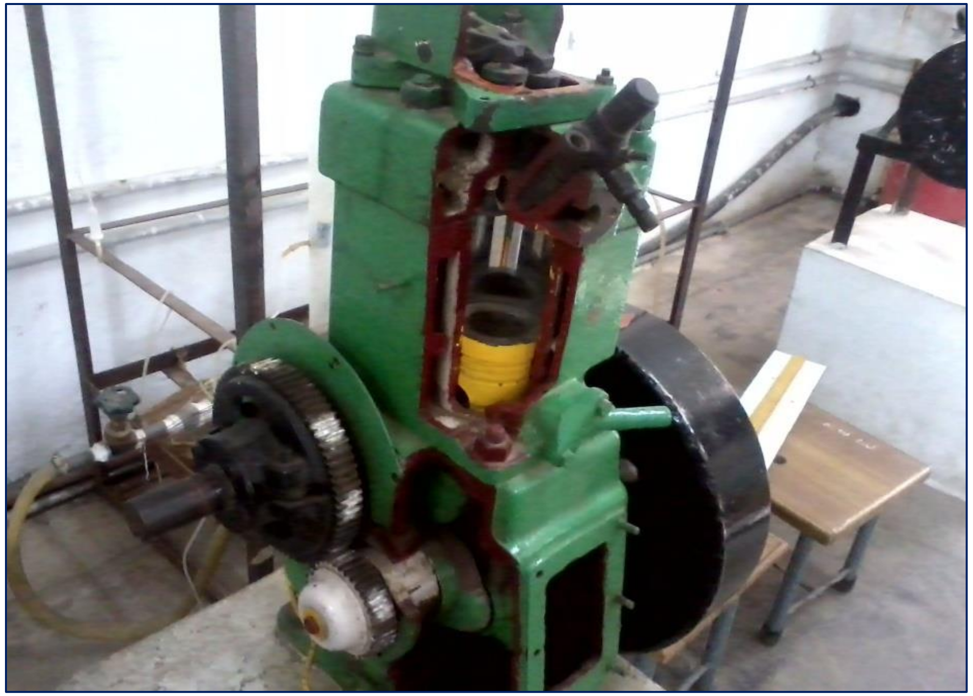
FACILITIES

Valve timing diagram for 4-Stroke Diesel engine

- A valve timing diagram is a graphical representation of the opening and closing of the intake and exhaust valve of the engine, The opening and closing of the valves of the engine depend upon the movement of piston from TDC to BDC.



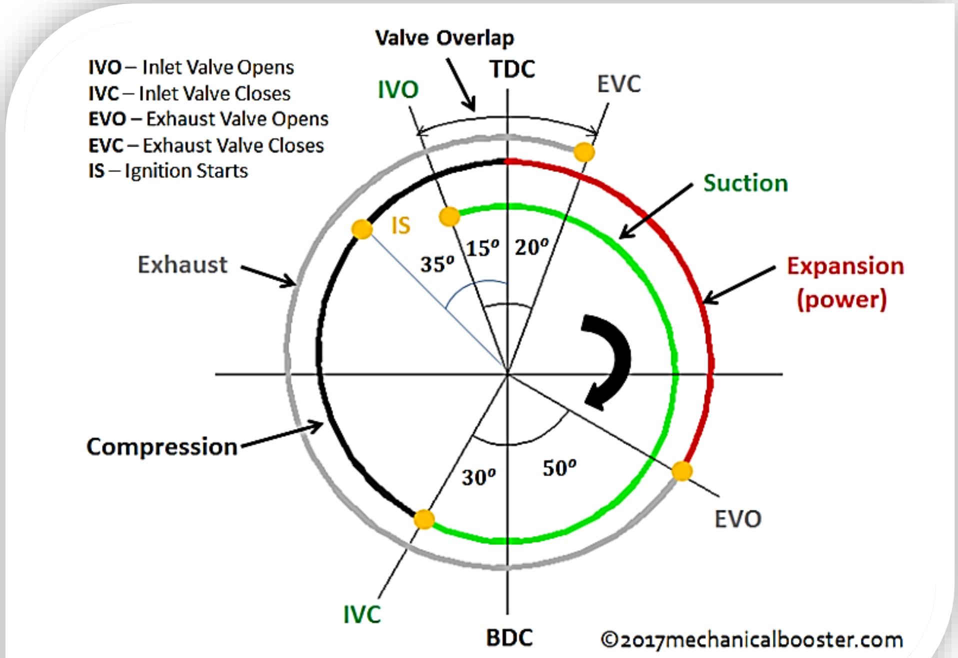
Valve Timing Diagram of 4 Stroke Diesel Engine



Cut Model of Diesel engine

Valve timing diagram for 4-Stroke petrol engine

- A valve timing diagram is a graphical representation of the opening and closing of the intake and exhaust valve of the engine, The opening and closing of the valves of the engine depend upon the movement of piston from TDC to BDC.

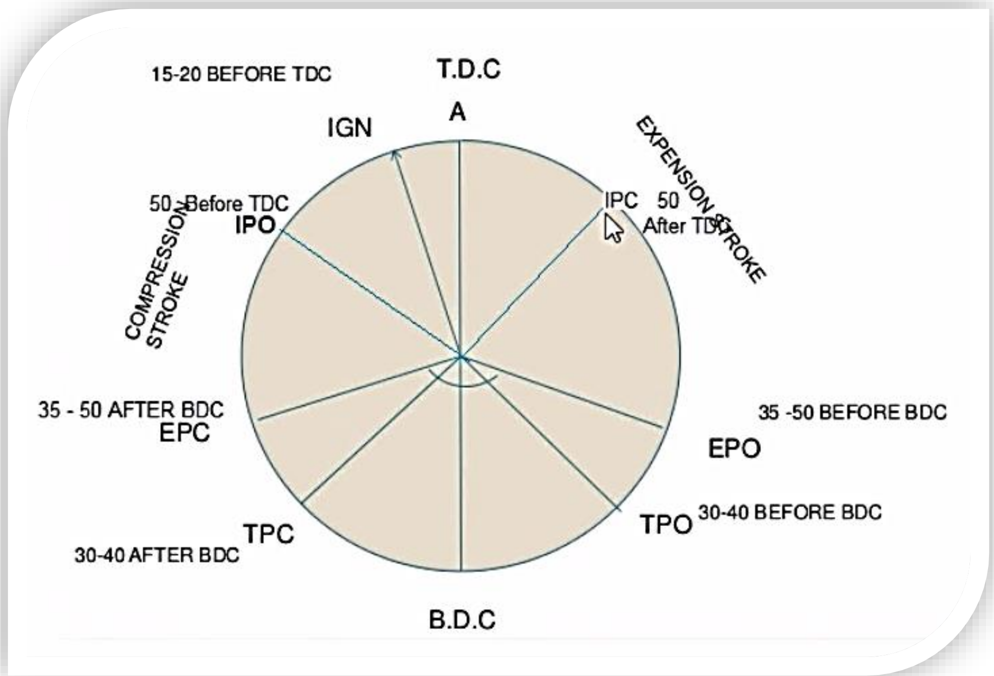


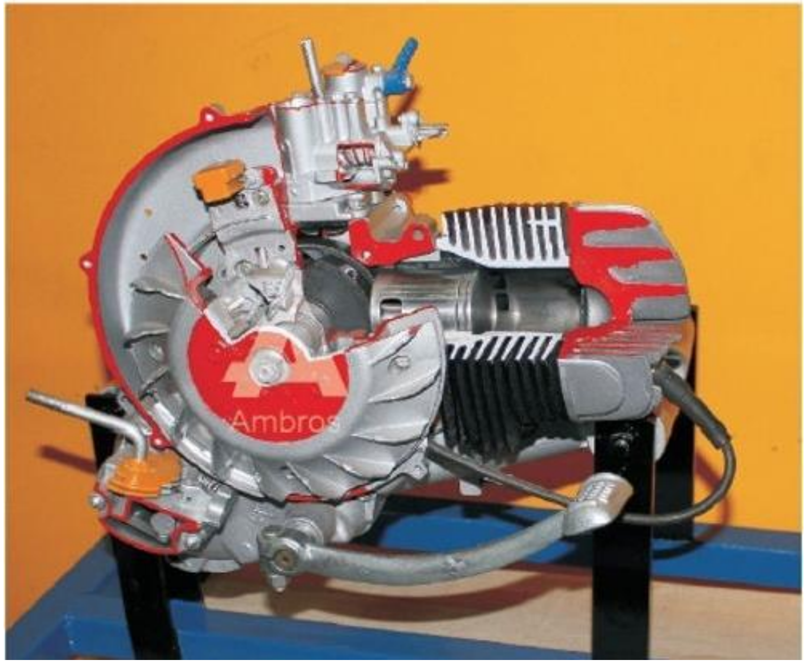
Valve Timing Diagram of 4 Stroke Petrol Engine

Cut Model of Petrol Engine

Port timing diagram for 2-Stroke petrol engine

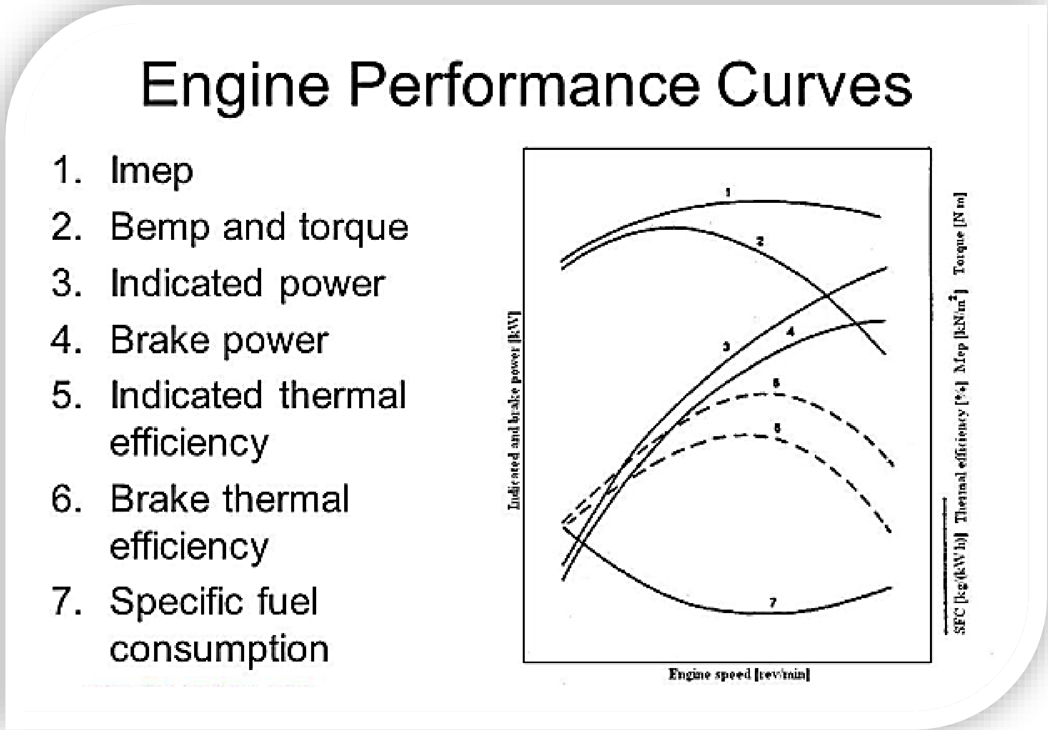
- A port timing diagram is a graphical representation of the opening and closing of the intake, exhaust and transfer ports of the engine, The opening and closing of the ports of the engine depend upon the movement of piston from TDC to BDC
- In two-stroke engine the cycle is completed in one revolution of the crankshaft.





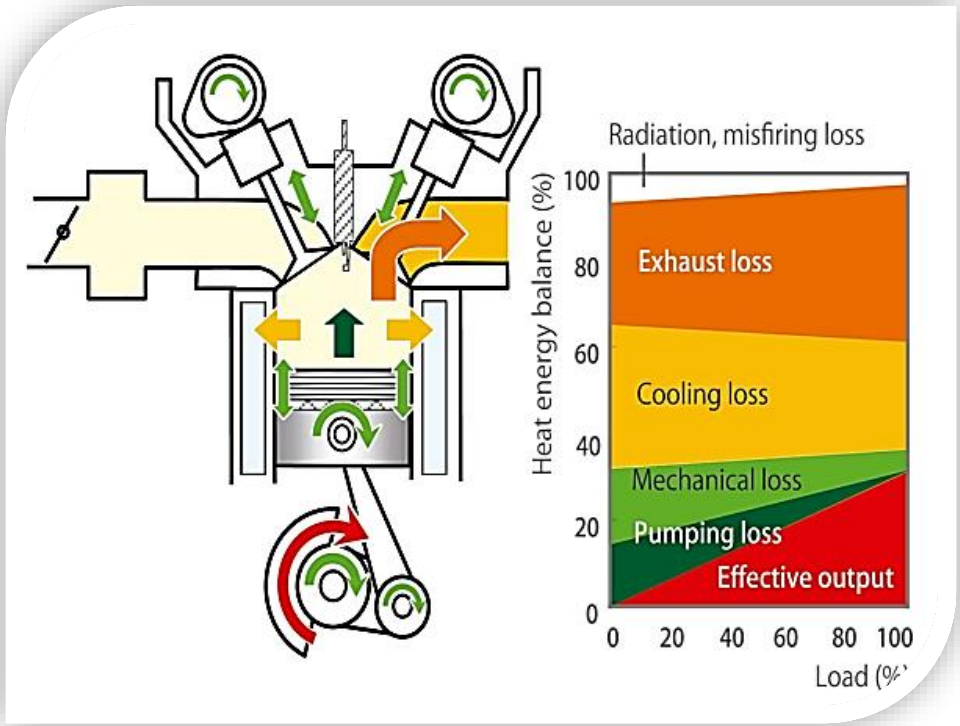
Cut Model of Petrol Engine

Performance test on 4-stroke/2-stroke single cylinder petrol engine



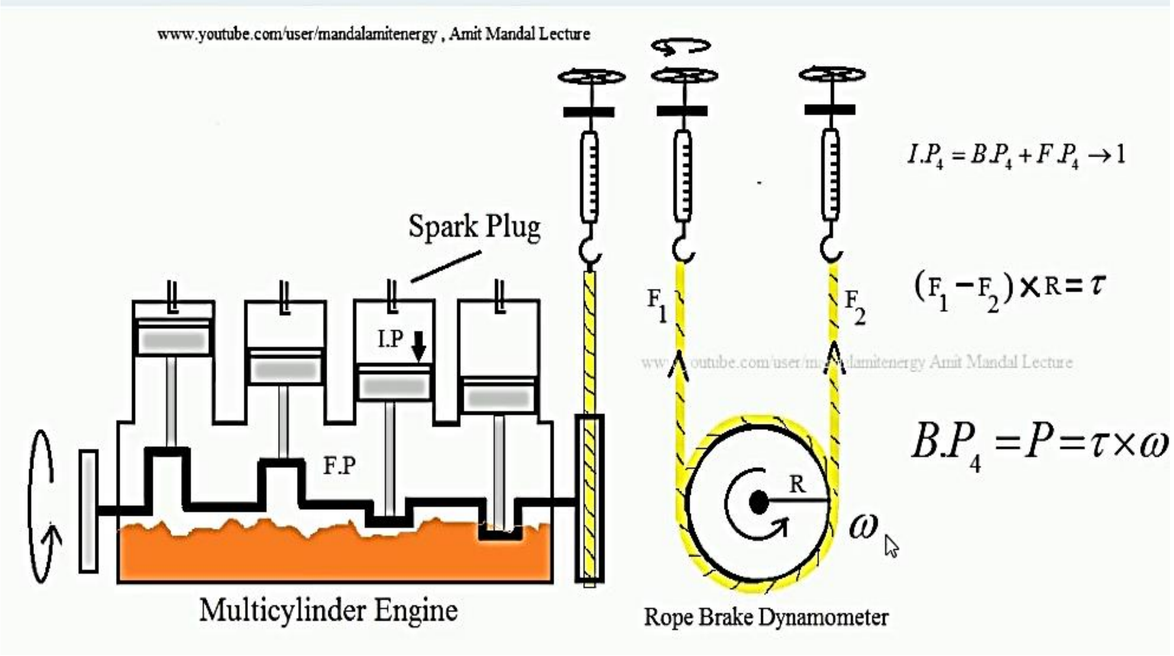
Single cylinder four stroke petrol engine test rig

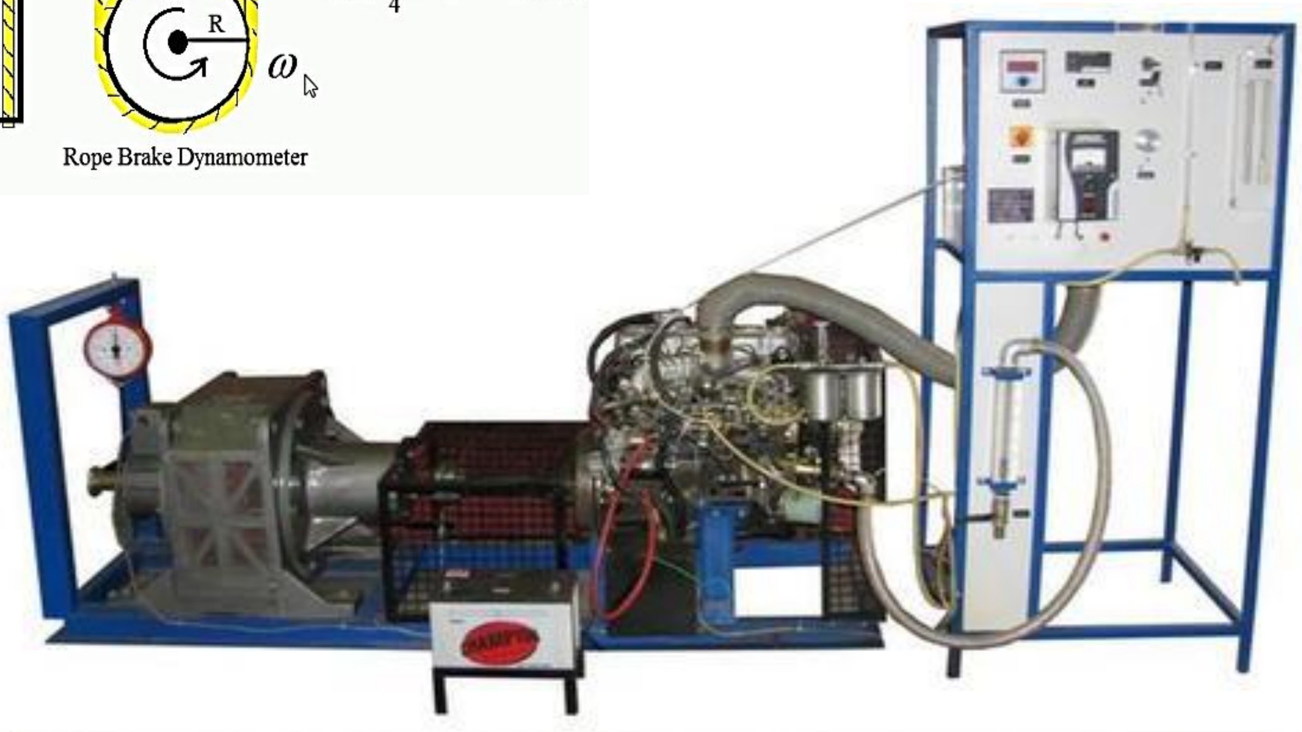
Heat balance test on 4-Stroke single cylinder Diesel engine



Single cylinder four stroke diesel engine test rig

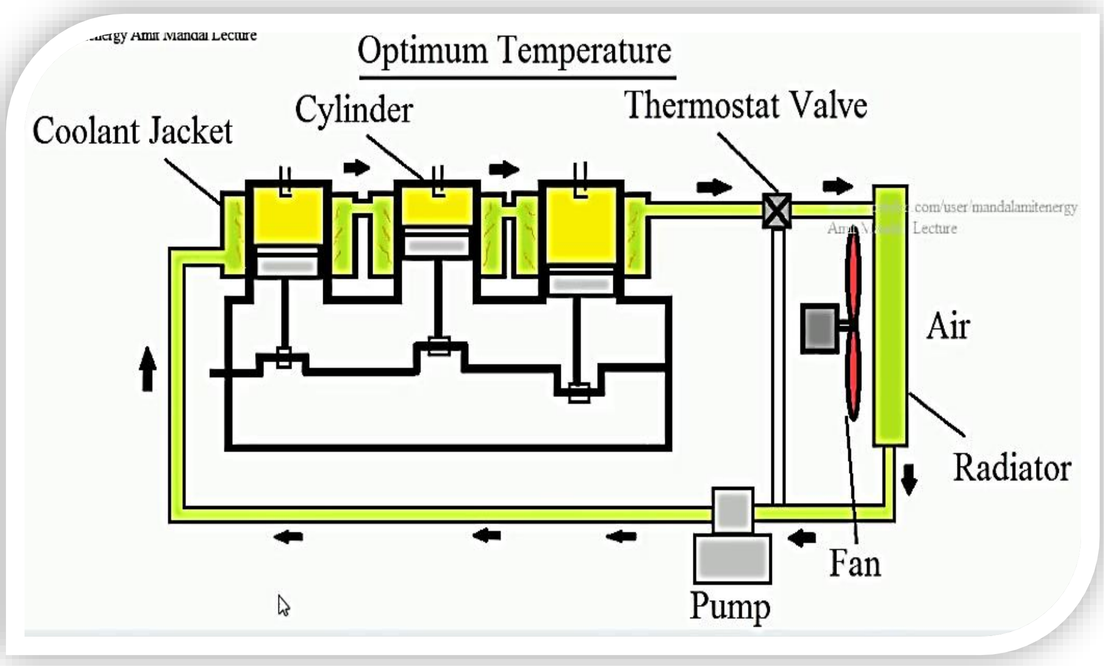
Morse test on multi-cylinder petrol engine





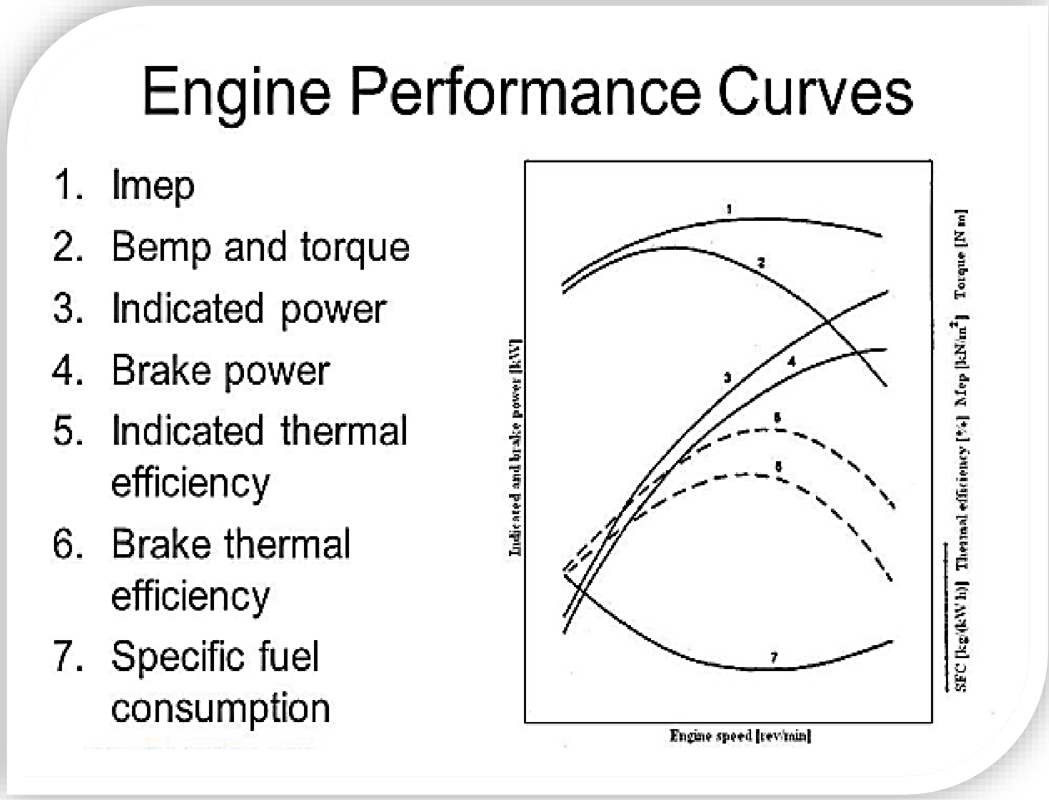
Multi-cylinder four stroke diesel engine test rig

Optimum cooling temperature test on single cylinder Diesel engine



Single cylinder four stroke diesel engine test rig

Performance test on 4-stroke single cylinder computerized Diesel engine



Computerized single cylinder four stroke diesel engine test rig

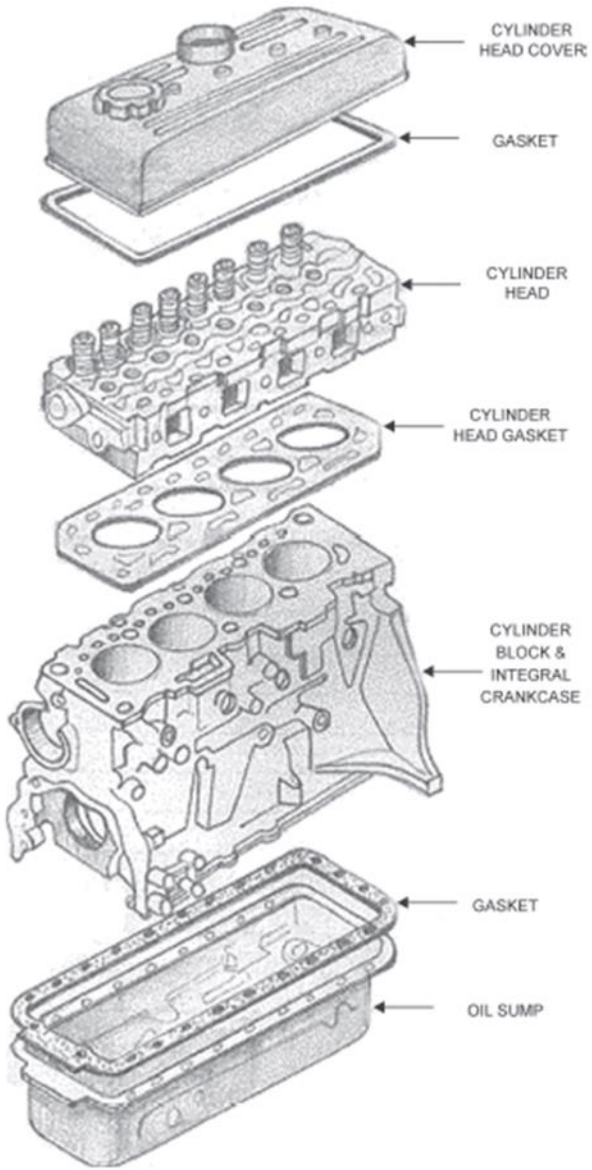
Permanence test on reciprocating compressor test rig

- An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air.

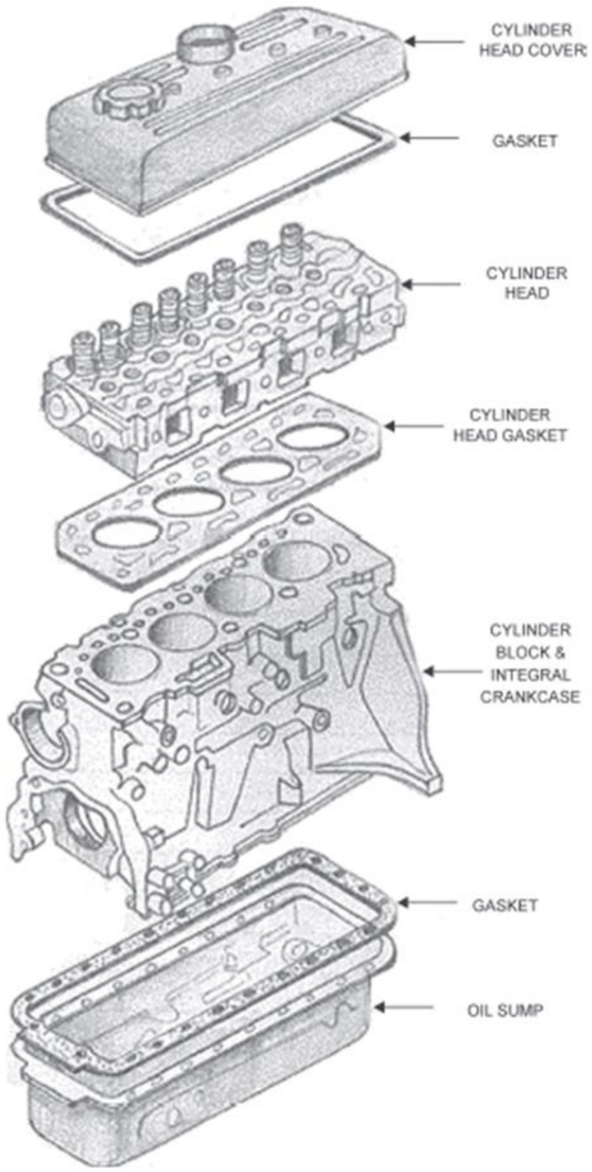
- This experimental set up demonstrates the students to evaluate
- a)Volumetric efficiency
- b) Isothermal efficiency

Reciprocating compressor test rig

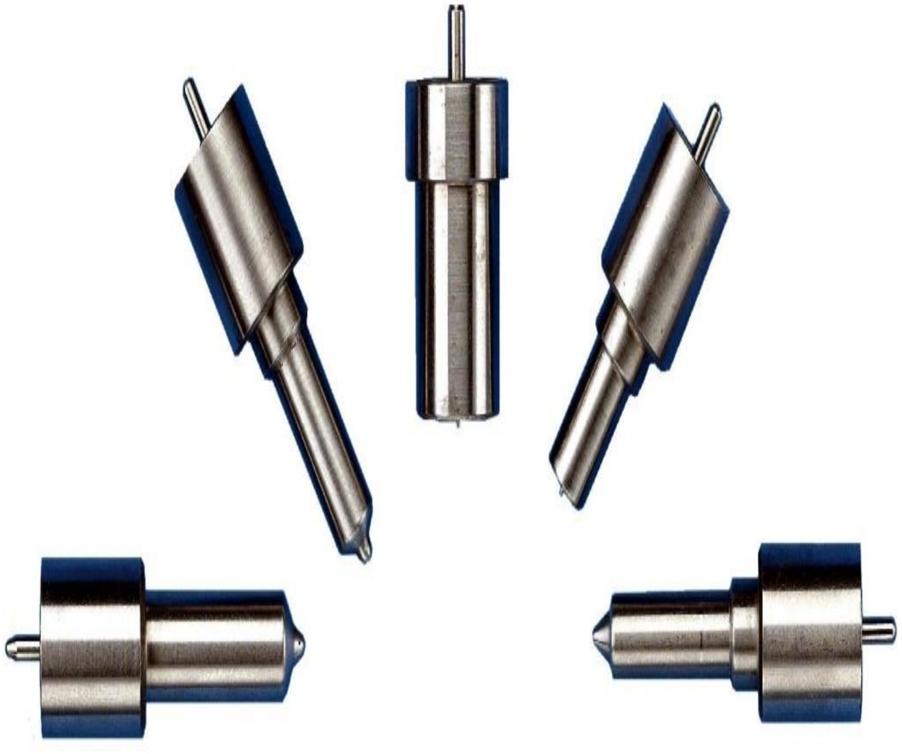
Dismantling, inspection and assembling of multi-cylinder petrol engine



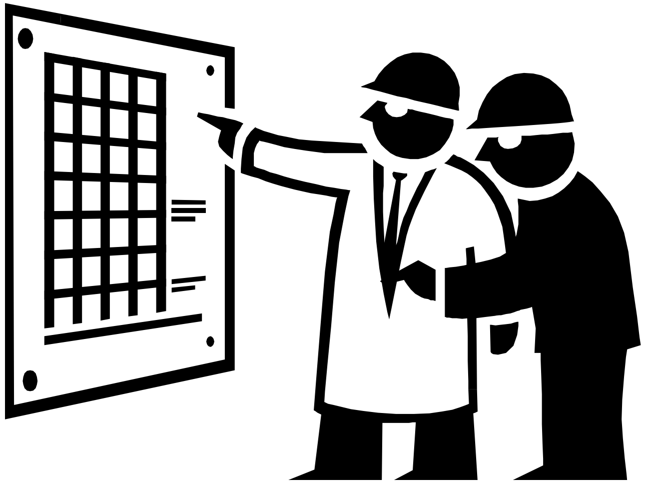
Dismantling, inspection and assembling of multi-cylinder Diesel engine



Testing of Diesel fuel injector



LABORATORY SAFETY RULES



- Keep yourself and others safe.
- Wear appropriate safety equipment.
- No loose clothes and long hair around machines.
- Clean up any spills immediately.
- Wear shoes to protect the feet from falling weights.
- Don’t play with machines/tools.

- Maintain discipline and be regular to the laboratory
- Carry the observation book and record to the laboratory
- Follow proper dress code in the laboratory
- Do not use any equipment unless you are trained
- Wear safety glasses or face shields when working with hazardous materials and/or equipment
- If you have long hair or loose clothes, make sure it is tied back or confined
- Keep the work area clear of all materials except those needed for your work
- Extra books, purses, etc. should be kept away from equipment
- Students are responsible for the proper disposal of used material if any in appropriate containers

- Wear shoes to protect your feet
- Check all electrical connections and mounting bolts before each use
- Check that all rotating parts are free to turn, and that there is no mechanical obstruction before operating
- If an equipment fails while being used, report it immediately to your lab assistant or in-charge
- Never try to fix the problem yourself because you could harm yourself and others
- Exercise care when working with or near hydraulically- or pneumatically-driven equipment. Sudden or unexpected motion can inflict serious injury
- If leaving a lab unattended, turn off all ignition sources
- Clean up your work area before leaving
- Wash hands before leaving the lab and before eating

Common Sense

Good common sense is needed for safety in a laboratory. It is expected that each student will work in a responsible manner and exercise good judgement and common sense. If at any time you are not sure how to handle a particular situation, ask your Lab in-charge or Instructor for advice. It is always better to ask questions than to risk harm to yourself or damage to the equipment. Do not touch anything with which you are not completely familiar.

3. Automotive Simulation Lab Protocol

Objectives and outcomes

COURSE OBJECTIVES:

- To introduce the basics of MATLAB & Simulink
- To model and simulate vehicle subsystems
- To model and simulate various powertrain systems

COURSE OUTCOMES:

After completion of the course, the student should be able to

CO-1: Understand the fundamentals of MATLAB & Simulink

CO-2: Perform modelling and simulation of vehicle subsystems

CO-3: Perform modelling and simulation of various powertrain systems

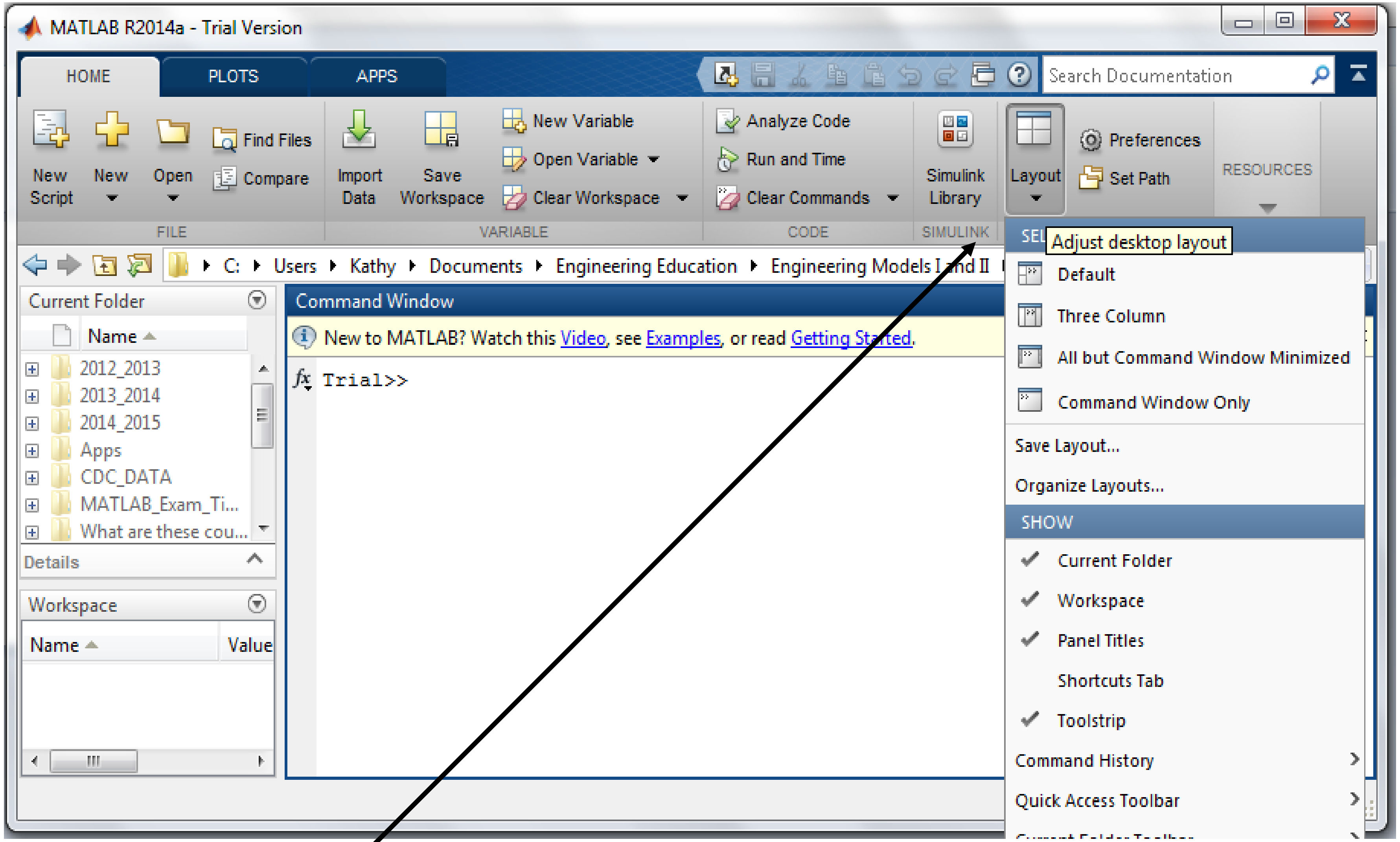
LIST OF EXPERIMENTS

1. Create variables and perform calculations using built-in functions
2. Create vectors, matrices and perform calculations on arrays
3. Data visualization using plot functions
4. Visualization of signal values and data exchange between Simulink and MATLAB
5. Modelling and simulation of cruise control model
6. Modelling and simulation of a quarter car model
7. Simulation of IC engine dynamometer model
8. Modelling and simulation of IC engine powered vehicle
9. Modelling and simulation of a DC motor
10. Simulation of battery pack model
11. Modelling and simulation of an electric vehicle
12. Simulation of hybrid electric vehicle model

What is MATLAB®?

- MATLAB® /Simulink® is a powerful software tool for:
- Performing mathematical computations and signal processing
- Analyzing and visualizing data (excellent graphics tools)
- Modeling physical systems and phenomena
- Testing engineering designs

MATLAB Desktop

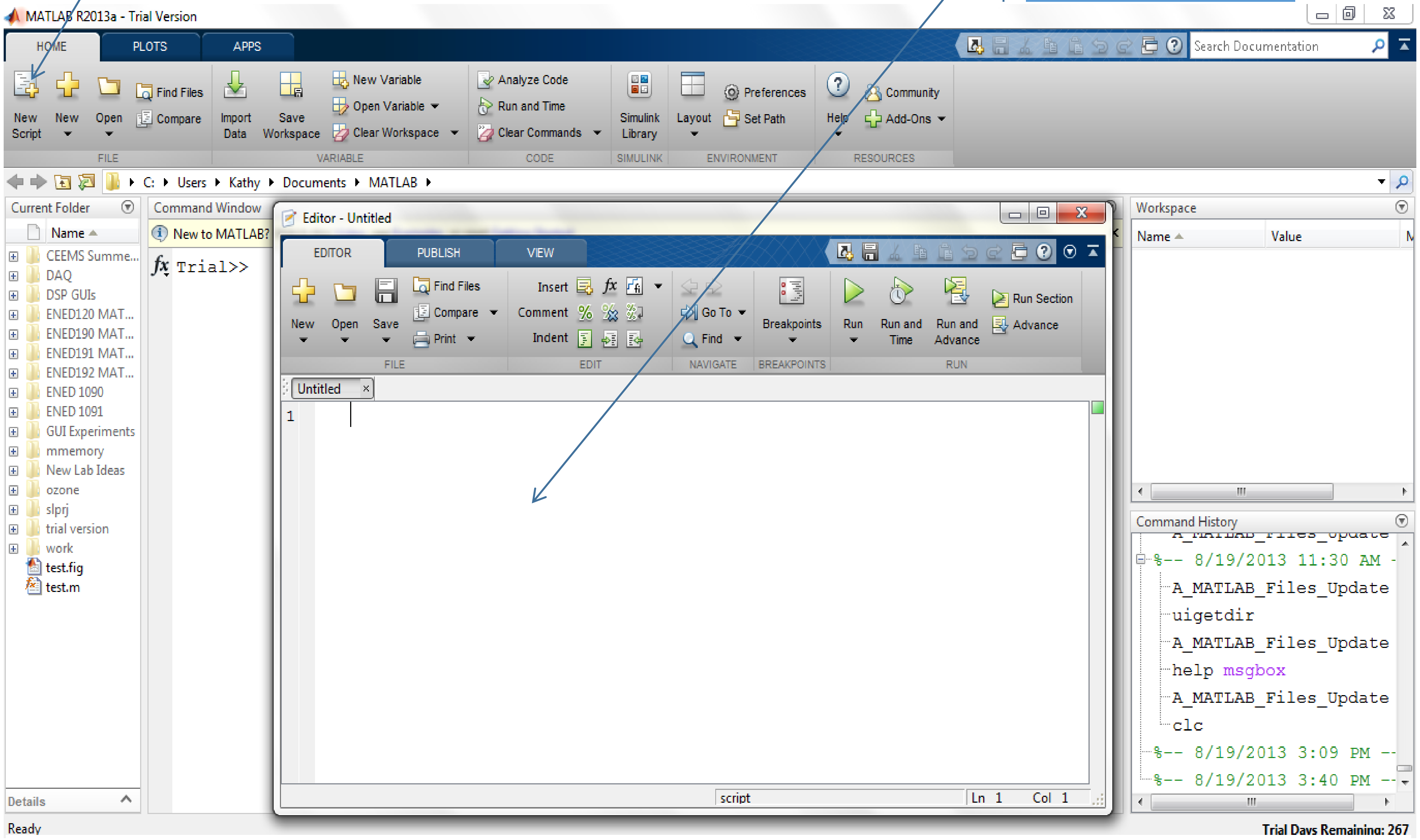


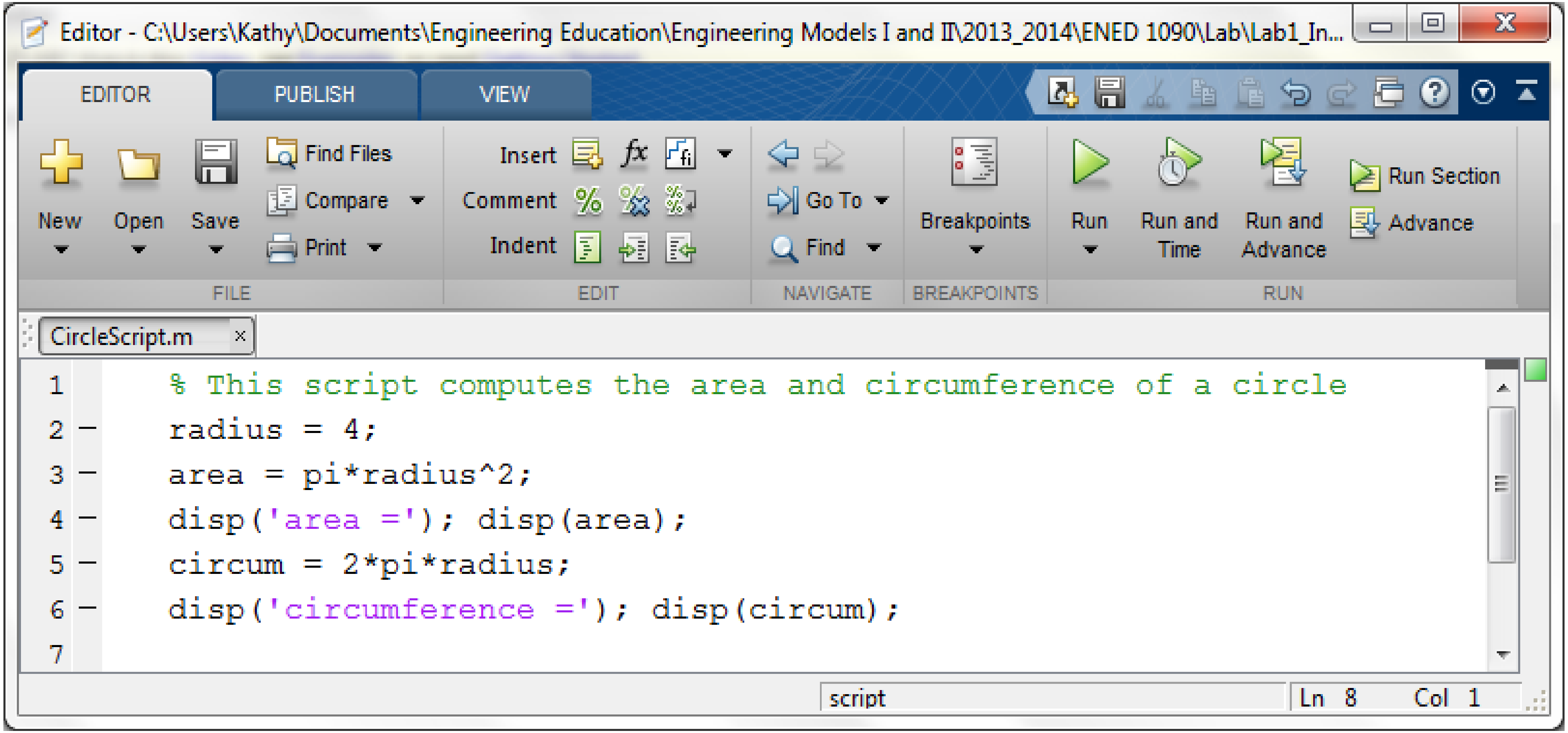
You can select what is on your desktop by Clicking on Layout. Go down to Command History and select docked.

Script Files

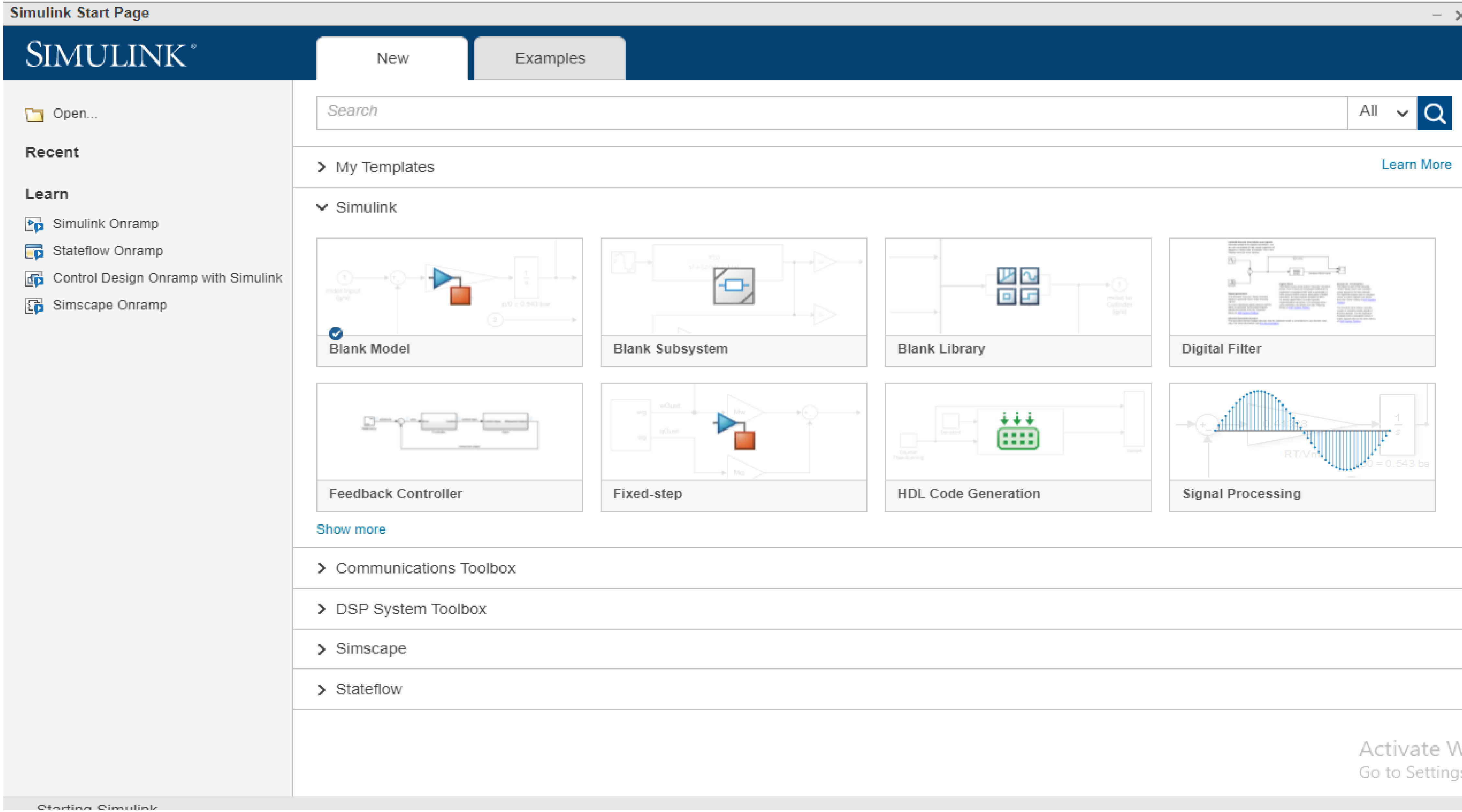
Click on New Script

Creates Blank Script File





- Save the file as Circle Script in your newly created folder.
- <u>Note</u>: Any line that starts with a % is a comment and turns green – it doesn't execute.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Stateflow Onramp
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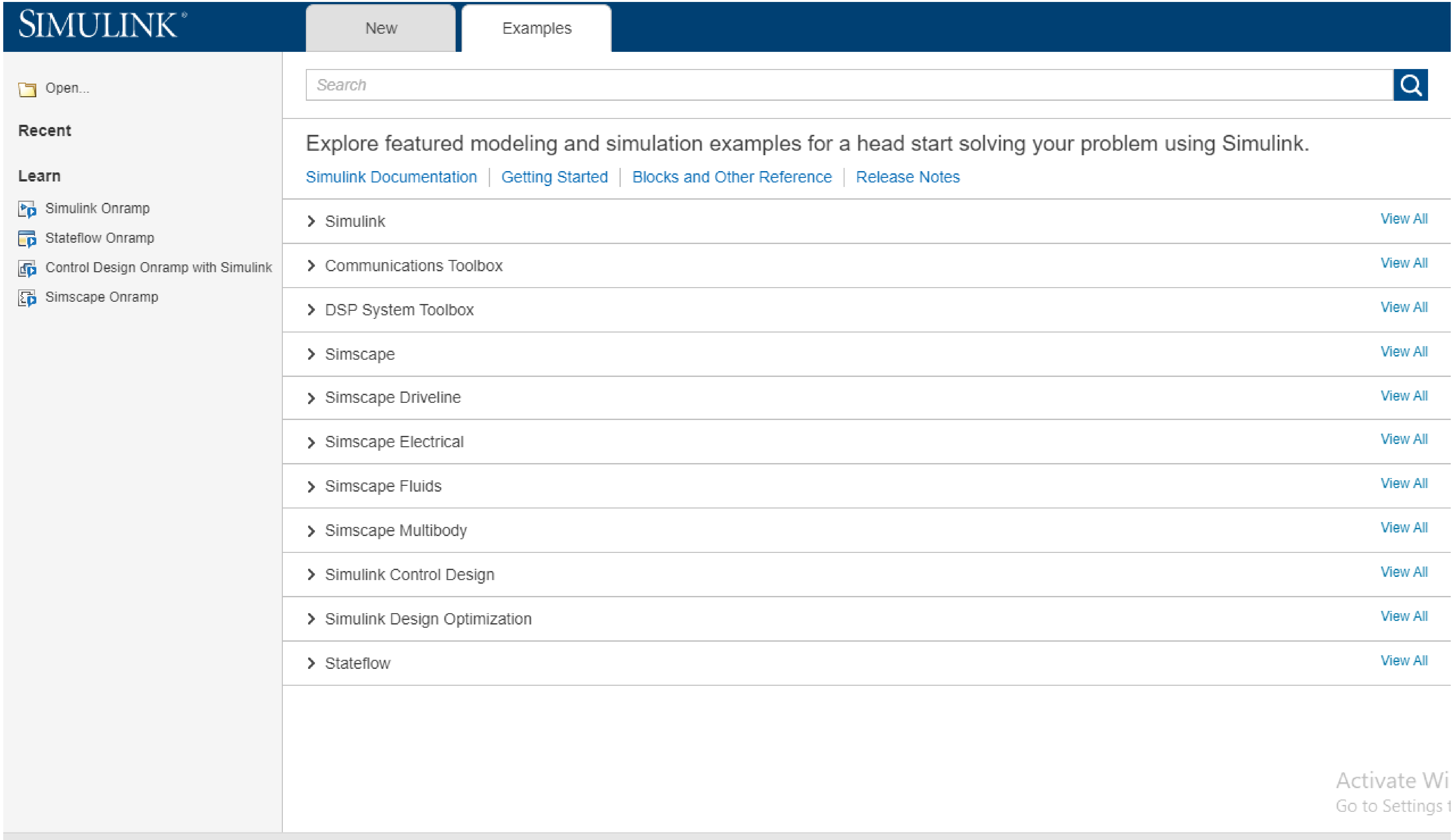
DSP System Toolbox
Simscape
Stateflow
Starting Simulink

Simulink

Examples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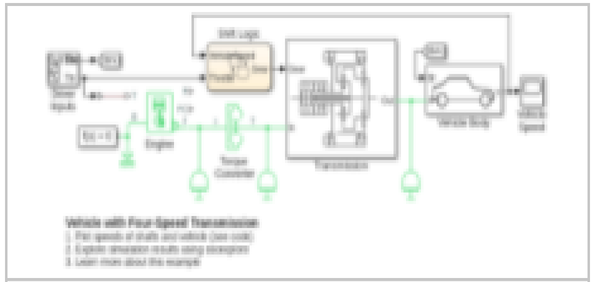
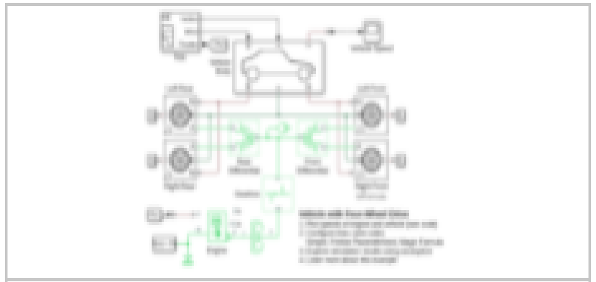
Examples

Simscape Driveline

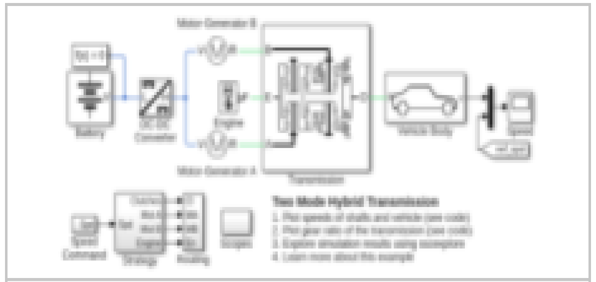
View All



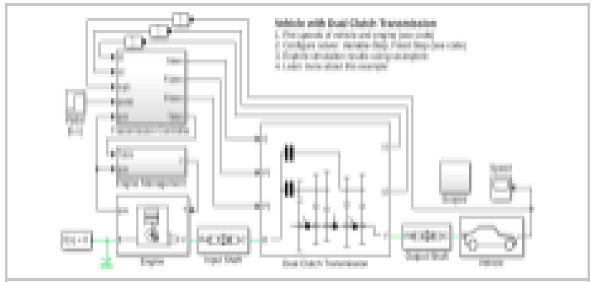
Vehicle with Four-Speed Transmis...



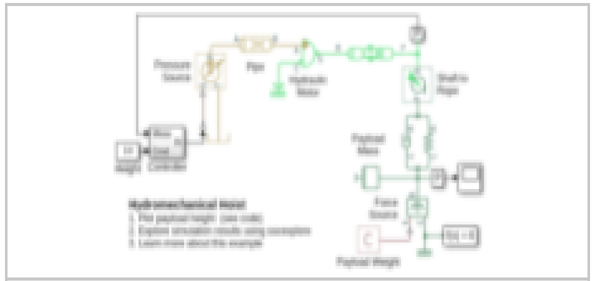
Vehicle with Four-Wheel Drive



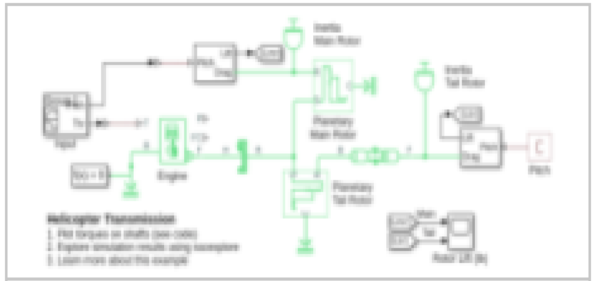
Two Mode Hybrid Transmission



Vehicle with Dual Clutch Transmis...

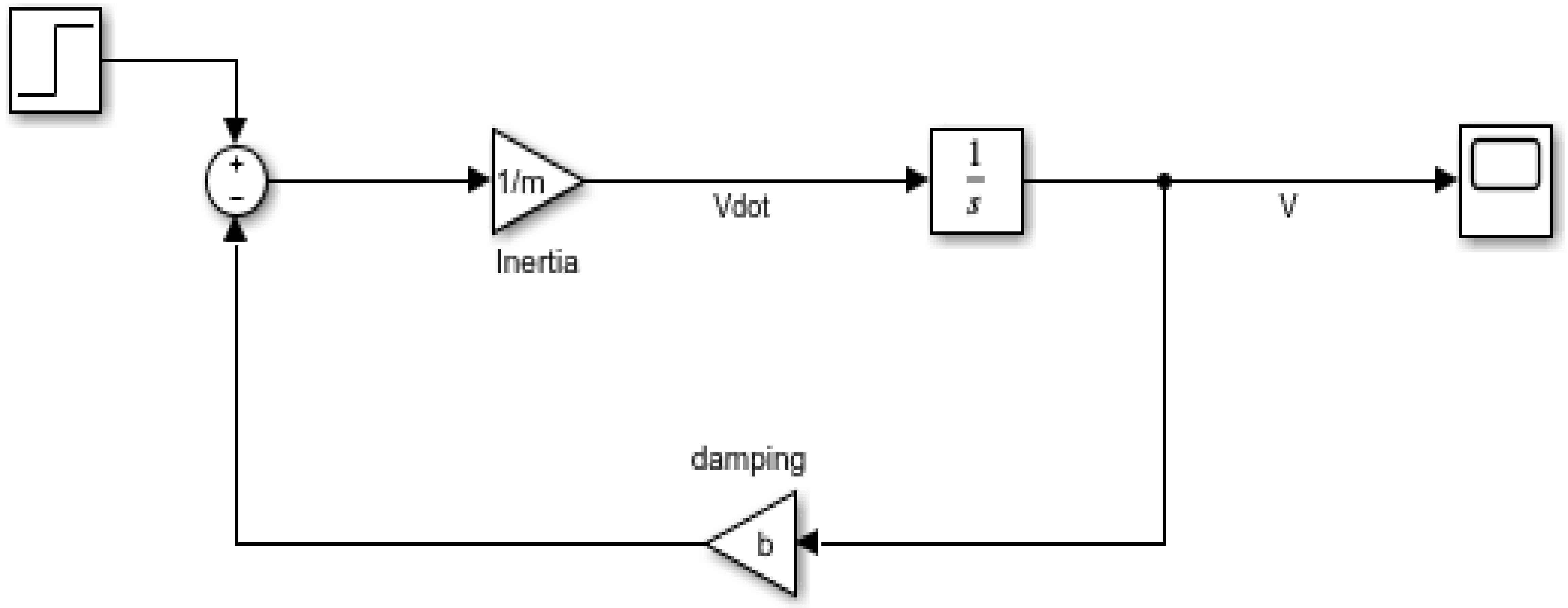


Hydromechanical Hoist

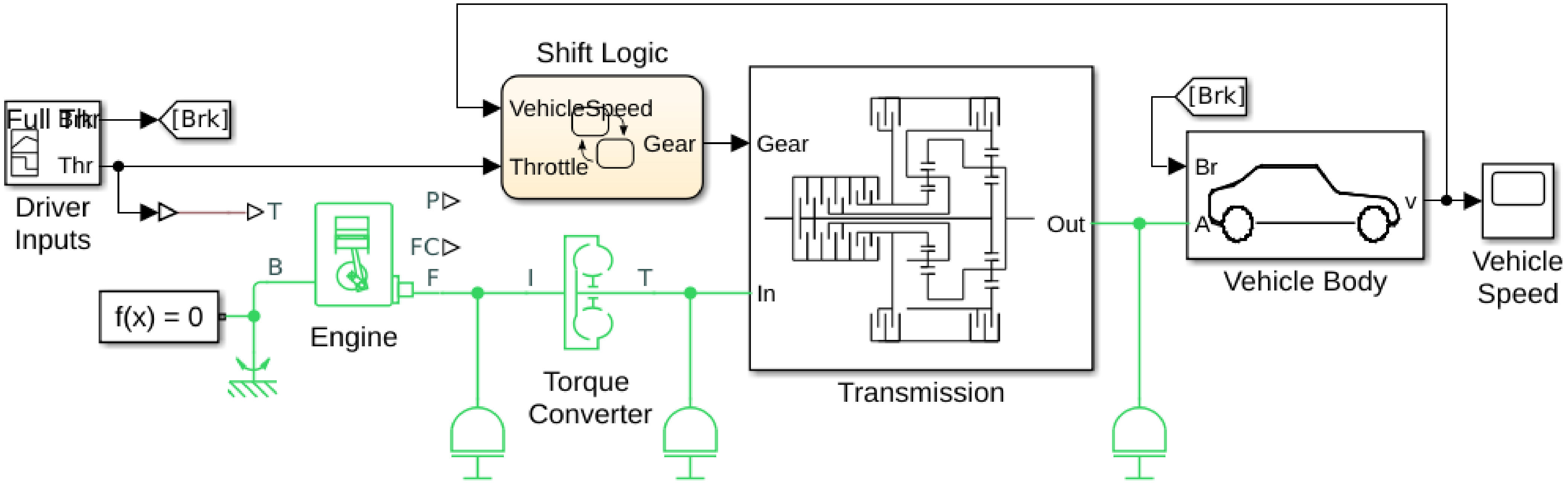


Helicopter Transmission

Simulink model



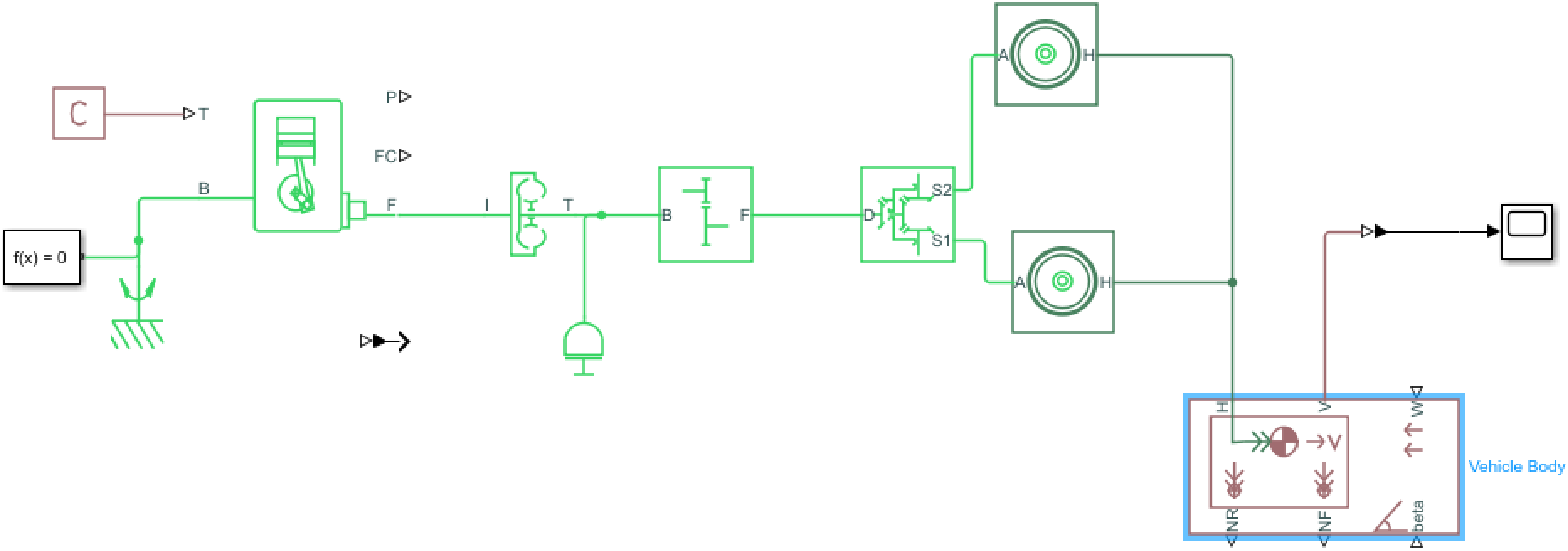
Four speed transmission



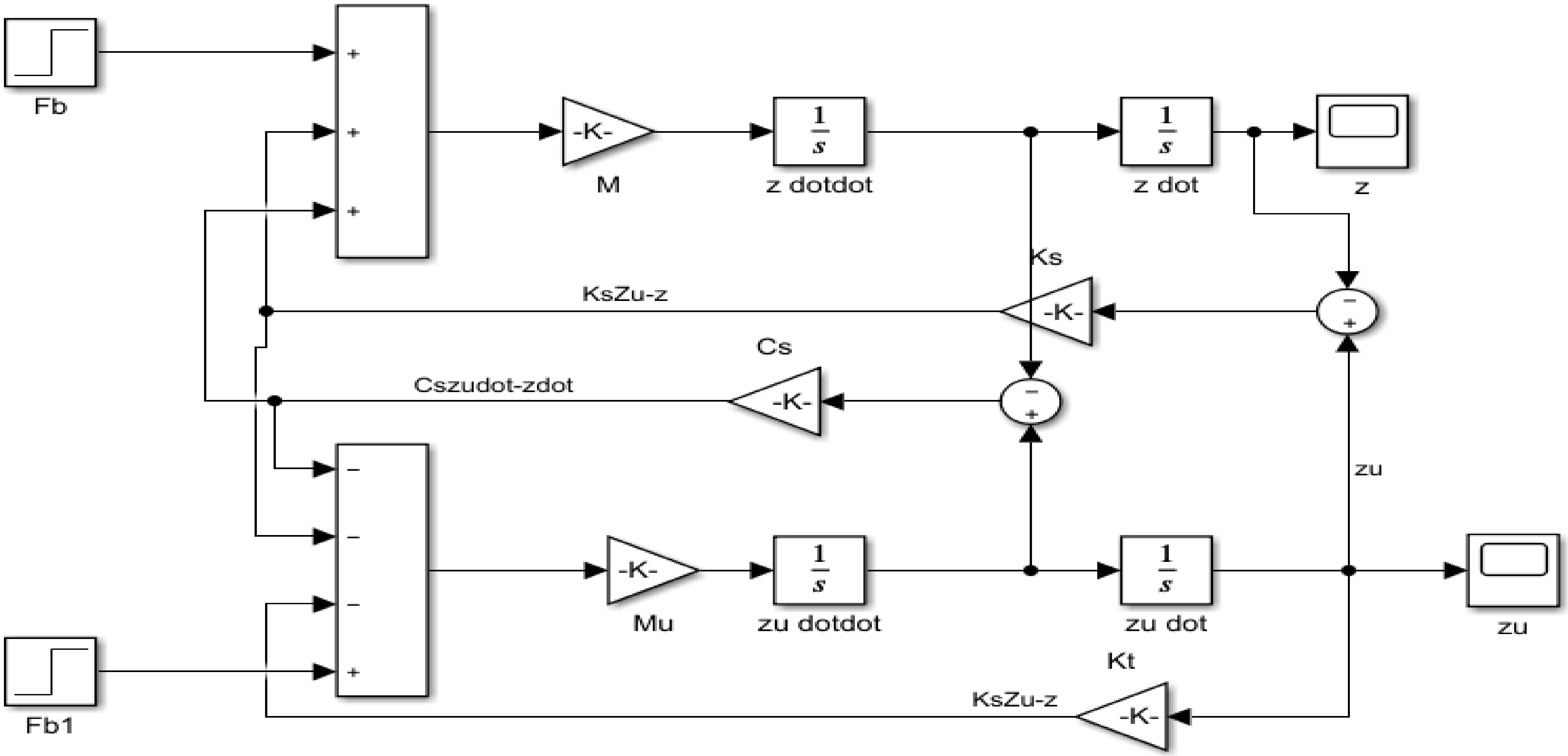
Vehicle with Four-Speed Transmission

1. Plot speeds of shafts and vehicle (see code)
2. Explore simulation results using sscexplore
3. Learn more about this example

IC engine model



Quarter car model



Thank You

4. CAM Lab

VNR Protocols for Laboratories
Department of Automobile Engineering

4. CAM Lab

VNR Protocol- CAM Lab- AED

VNR PROTOCOL

CAM LAB

TAMASOMA JYOTIRGAMAYA

Department of Automobile Engineering

VNR Protocol- CAM Lab- AED

CAM

- CAM systems allow for rapid development and modifying of designs and documentation.
- The 3D geometric model produced becomes a common element for engineering analysis (FEA), machining process planning (including CNC part programming, documentation (including engineering drawings), quality control, and so on.
- The coupling of CAD and CAM considerably shortens the time needed to bring a new product to market.
- Increased productivity is generally the justification for using CAM system.

PURPOSE OF THIS LABORATORY

To understand the meaning of various G and M codes

and also

writing of CNC Programs, simulation and machining of work pieces

History of CNC

1949 - US Air Force asks MIT to develop a "numerically controlled" machine.

1952 - Prototype NC machine demonstrated (punched tape input)

1980 - CNC machines (computer used to link directly to controller)

1990 - DNC: external computer “drip feeds” control programmer to machine tool controller

Motivation and uses

To manufacture complex curved geometries in 2D or 3D was extremely expensive by mechanical means (which usually would require complex jigs to control the cutter motions)

Machining components with repeatable accuracy

Unmanned machining operations

Advantages of CNC

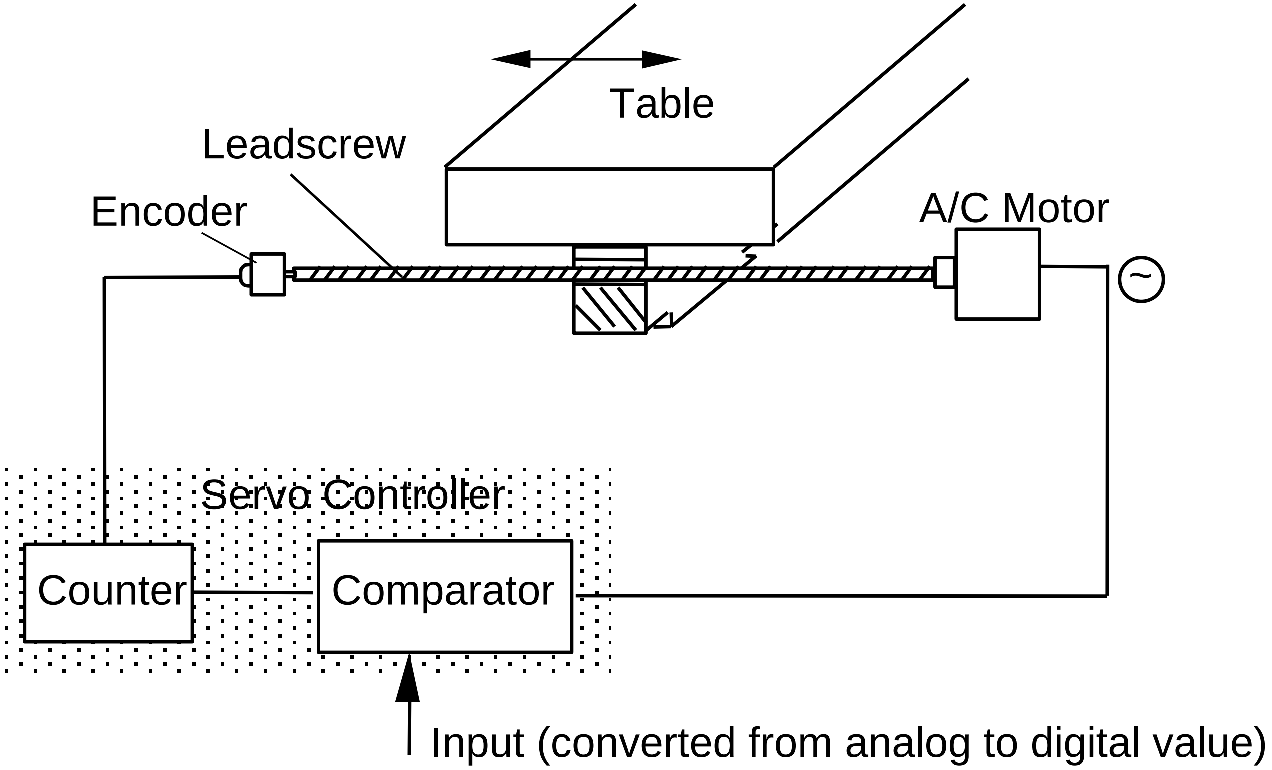
- Easier to program;
- Easy storage of existing programs;
- Easy to change a program
- Avoids human errors
- NC machines are safer to operate
- Complex geometry is produced as cheaply as simple ones
- Usually generates closer tolerances than manual machines

Conventional milling machines

Vertical milling machine

NC machines

Motion control is done by: servo-controlled motors



Numerical Control

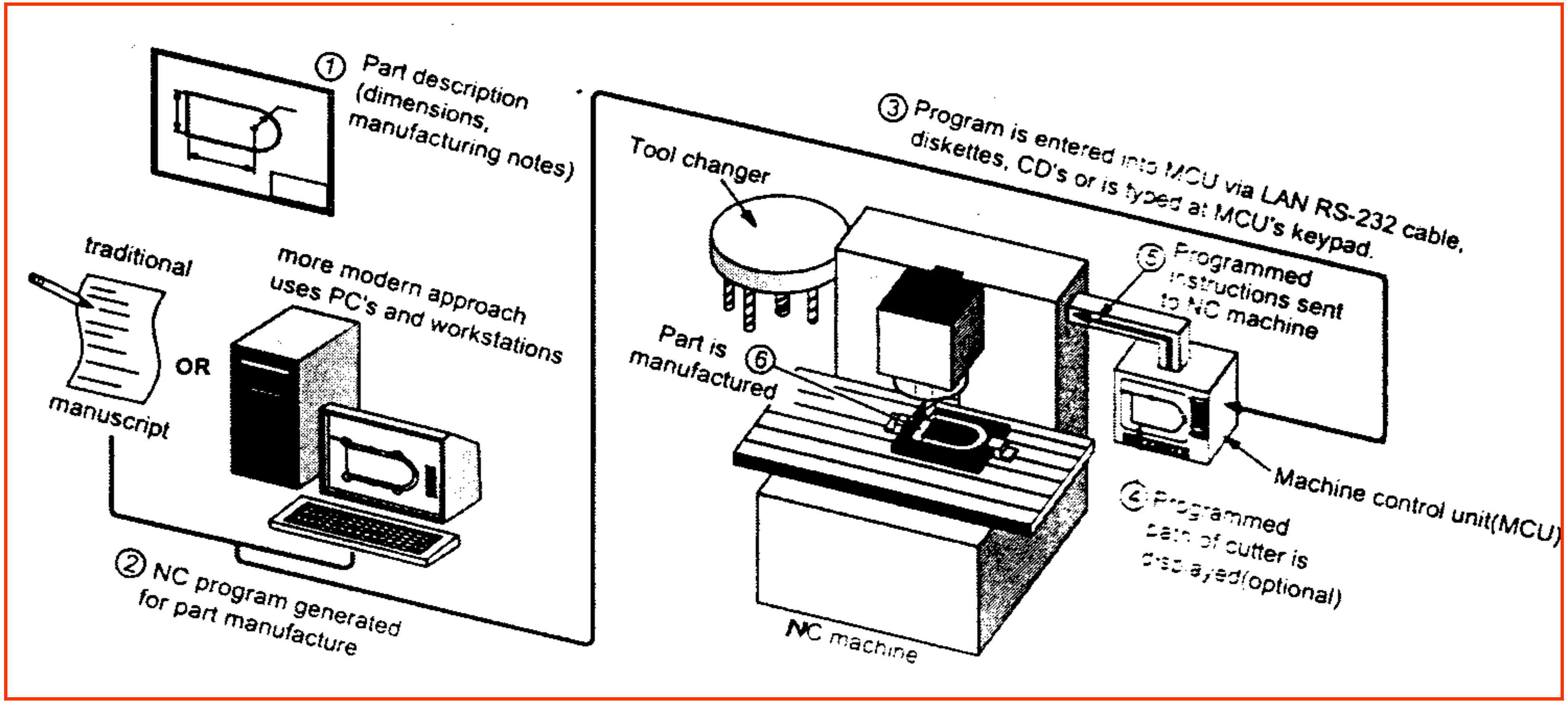
- Numerical control is a method of automatically operating a manufacturing machine based on a code of letters, numbers, and special characters.

- The numerical data required to produce a part is provided to a machine in the form of a program, called *part program or CNC program*.

- The program is translated into the appropriate electrical signals for input to motors that run the machine.

Computer Numerical Control (CNC)

A CNC machine is an NC machine with the added feature of an on-board computer.

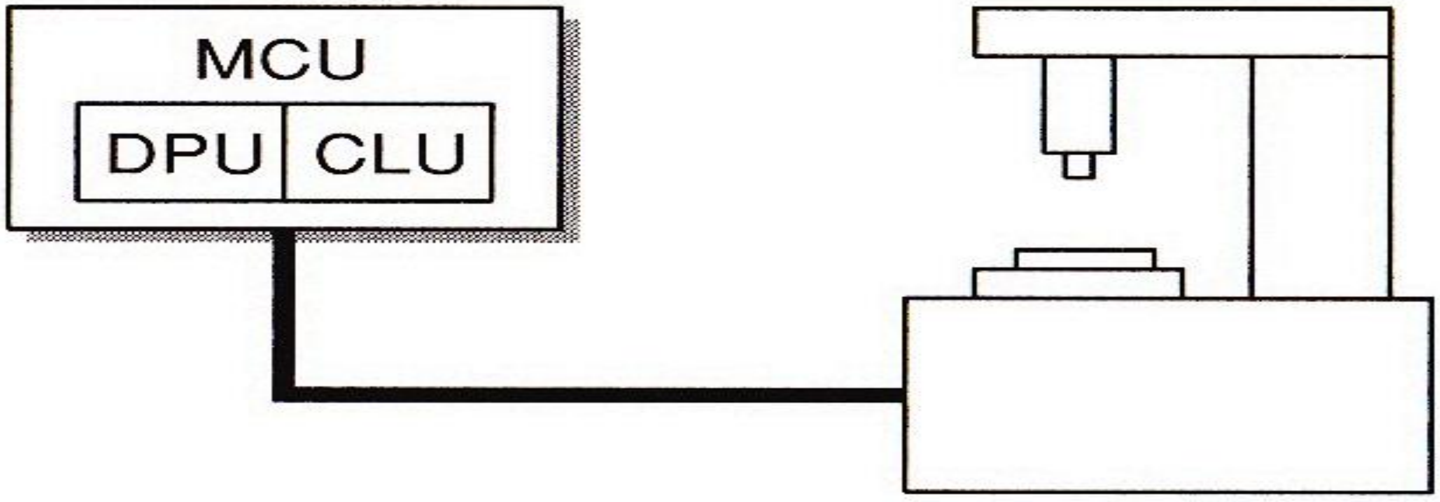


Hardware Configuration of NC Machine

Machine Control Unit (MCU) the brain of the NC machine.

The Data Processing Unit (DPU) reads the part program.

The Control Loop Unit (CLU) controls the machine tool operation.



CNC XLTURN MACHING CENTER

VNR Protocol- CAM Lab- AED

CNC XLMILL MACHING CENTER

VNR Protocol- CAM Lab- AED

CNC Machines

Machining Centers, equipped with automatic tool changers, are capable of changing 90 or more tools. Can perform milling, drilling, tapping, boring… on many faces.

CNC Machines

Turning Centers are capable of executing many different types of lathe cutting operations simultaneously on a rotating part.

CNC Controllers

The NC controller is the brain of the NC system, it controls all functions of the machine.

- Motion control deals with the tool position, orientation and speed.

- Auxiliary control deals with spindle rpm, tool change, fixture clamping and coolant.

- Many different types of controllers are available in the market (GE, Fanuc, Allen-Bradley, Okuma, Bendix, …).

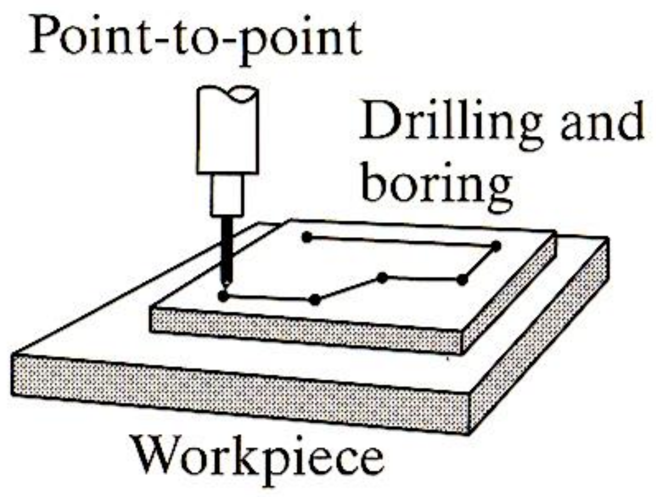
There are two basic types of control systems:

- point-to-point and continuous path.

Point-to-Point Tool Movements

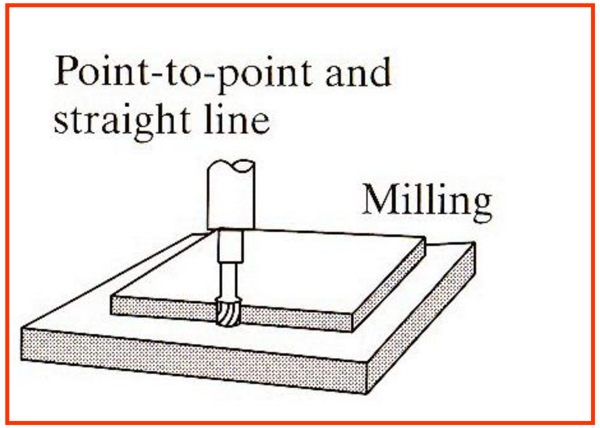
Point-to-point control systems cause the tool to move to a point on the part and execute an operation at that point only. The tool is not in continuous contact with the part while it is moving.

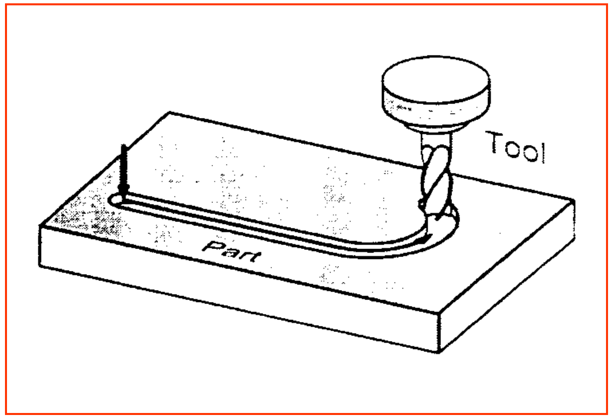
Drilling, reaming, punching, boring and tapping are examples of point-to-point operations.

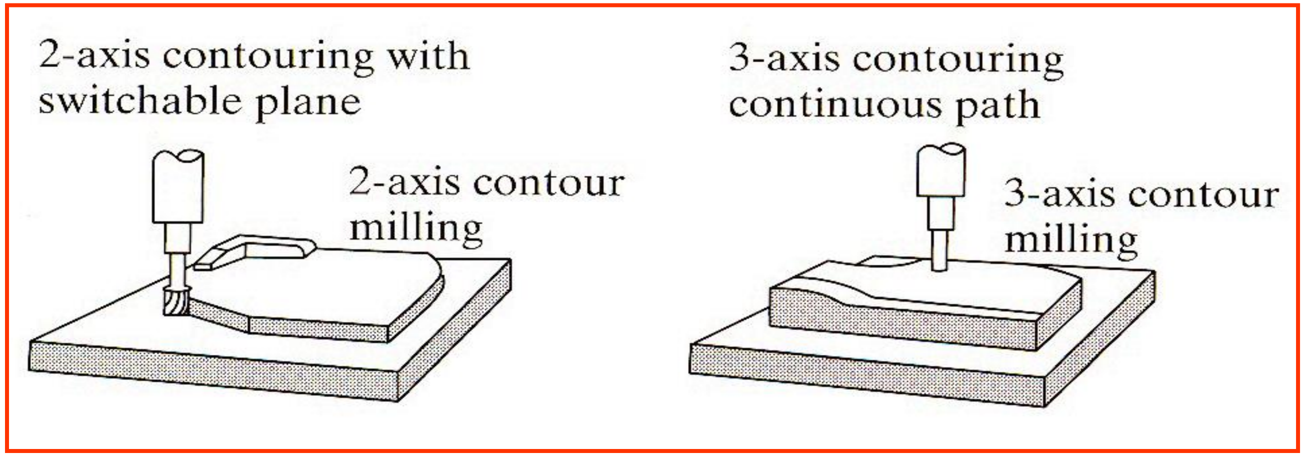


Continuous-Path Tool Movements

Continuous-path controllers cause the tool to maintain continuous contact with the part as the tool cuts a contour shape. These operations include milling along any lines at any angle, milling arcs and lathe turning.



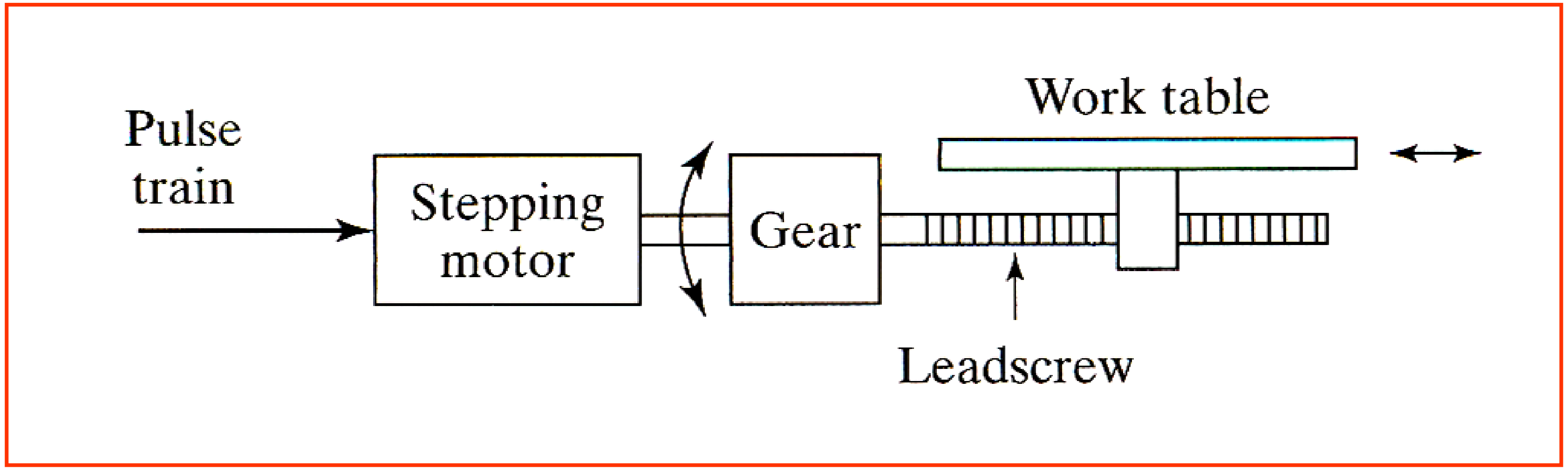




Loop Systems for Controlling Tool Movement

Open Loop System

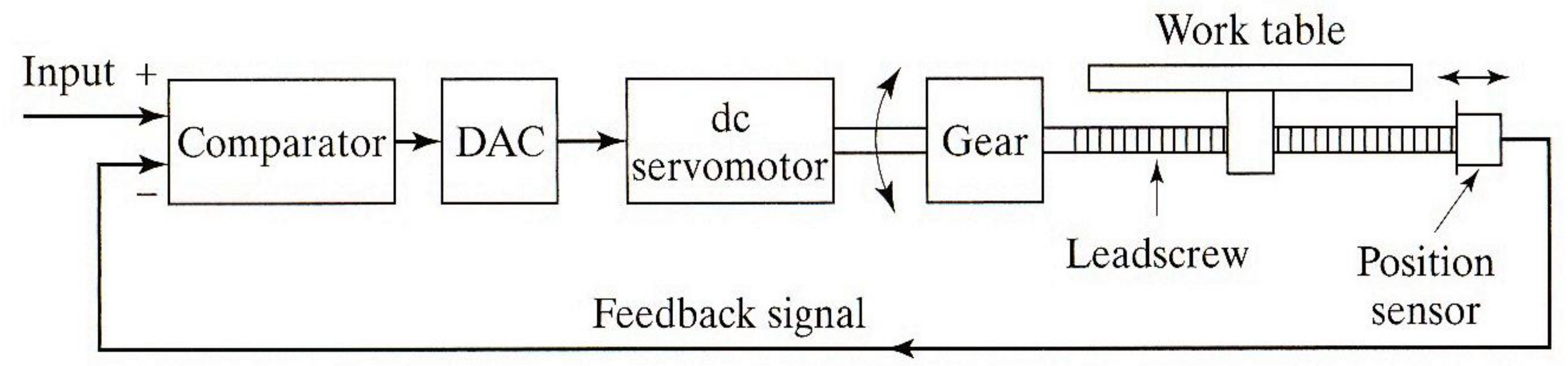
Uses stepping motor to create movement. Motors rotate a fixed amount for each pulse received from the MCU. The motor sends a signal back indicating that the movement is completed. No feedback to check how close the actual machine movement comes to the exact movement programmed.



Loop Systems for Controlling Tool Movement

Closed Loop System

AC, DC, and hydraulic servo-motors are used. The speed of these motors are variable and controlled by the amount of current or fluid. The motors are connect to the spindle and the table. A position sensor continuously monitors the movement and sends back a single to Comparator to make adjustments.



Flow of Computer-Aided CNC Processing

- Develop or obtain the 3D geometric model of the part, using CAD.
- Decide which machining operations and cutter-path directions are required (computer assisted).
- Choose the tooling required (computer assisted).
- Run CAM software to generate the CNC part program.
- Verify and edit program.
- Download the part program to the appropriate machine.
- Verify the program on the actual machine and edit if necessary.
- Run the program and produce the part.

Basic Concept of Part Programming

Part programming contains geometric data about the part and motion information to move the cutting tool with respect to the work piece.

Basically, the machine receives instructions as a sequence of blocks containing commands to set machine parameters; speed, feed and other relevant information.

A block is equivalent to a line of codes in a part program.

Block number	G-code	Coordinates	Tool number	Special function
N135	G01	X1.0 Y1.0 Z0.125	T01	F5.0

Basic Concept of Part Programming

Preparatory command (G code)

The G codes prepare the MCU for a given operation, typically involving a cutter motion.

G00	rapid motion, point-to-point positioning
G01	linear interpolation (generating a sloped or straight cut)
G06	parabolic interpolation (produces a segment of a parabola)
G17	XY plane selection
G20	circular interpolation
G28	automatic return to reference point
G33	thread cutting

Basic Concept of Part Programming

Miscellaneous commands (M code)

M00	program stop
M03	start spindle rotation (cw)
M06	tool change
M07	turn coolant on

Feed commands (F code)

Used to specify the cutter feed rates in inch per minute.

Speed commands (S code)

Used to specify the spindle speed in rpm.

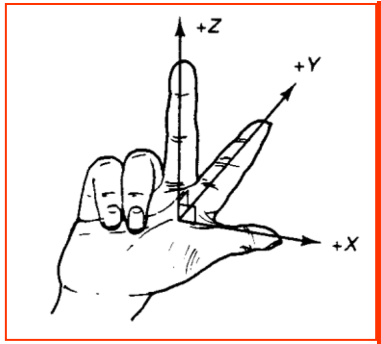
Tool commands (T code)

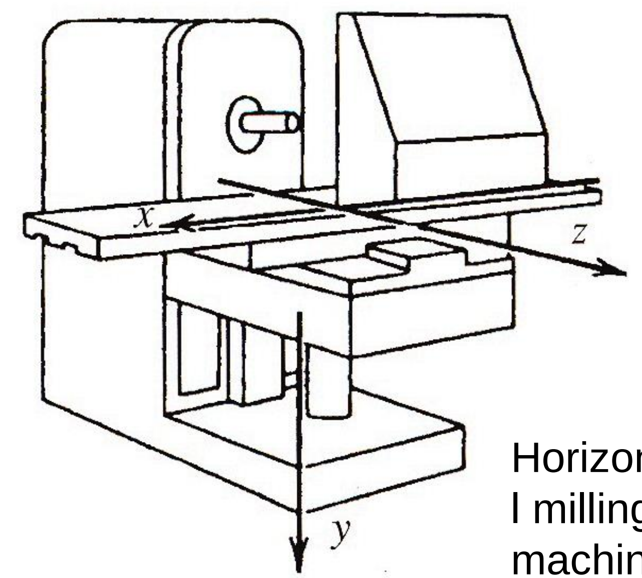
Specifies which tool to be used, machines with automatic tool changer.

CNC Machine Axes of Motion

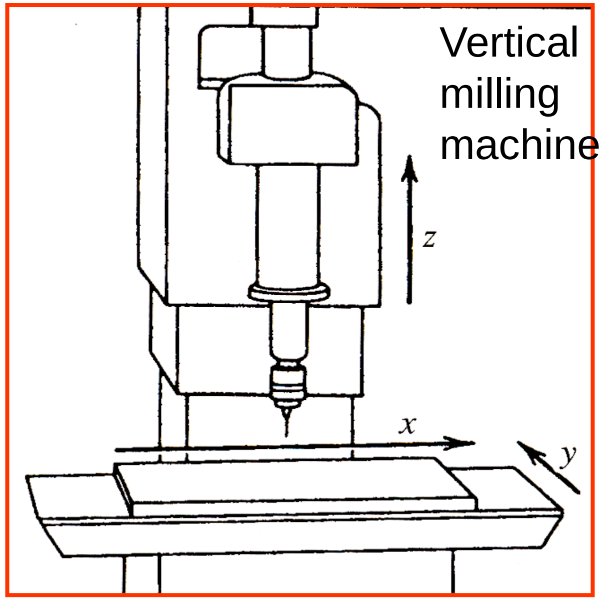
The coordinate system used for the tool path must be identical to the coordinate system used by the CNC machine. The standards for machine axes are established according to the industry standard report EIA RS-267A.

Right hand rule





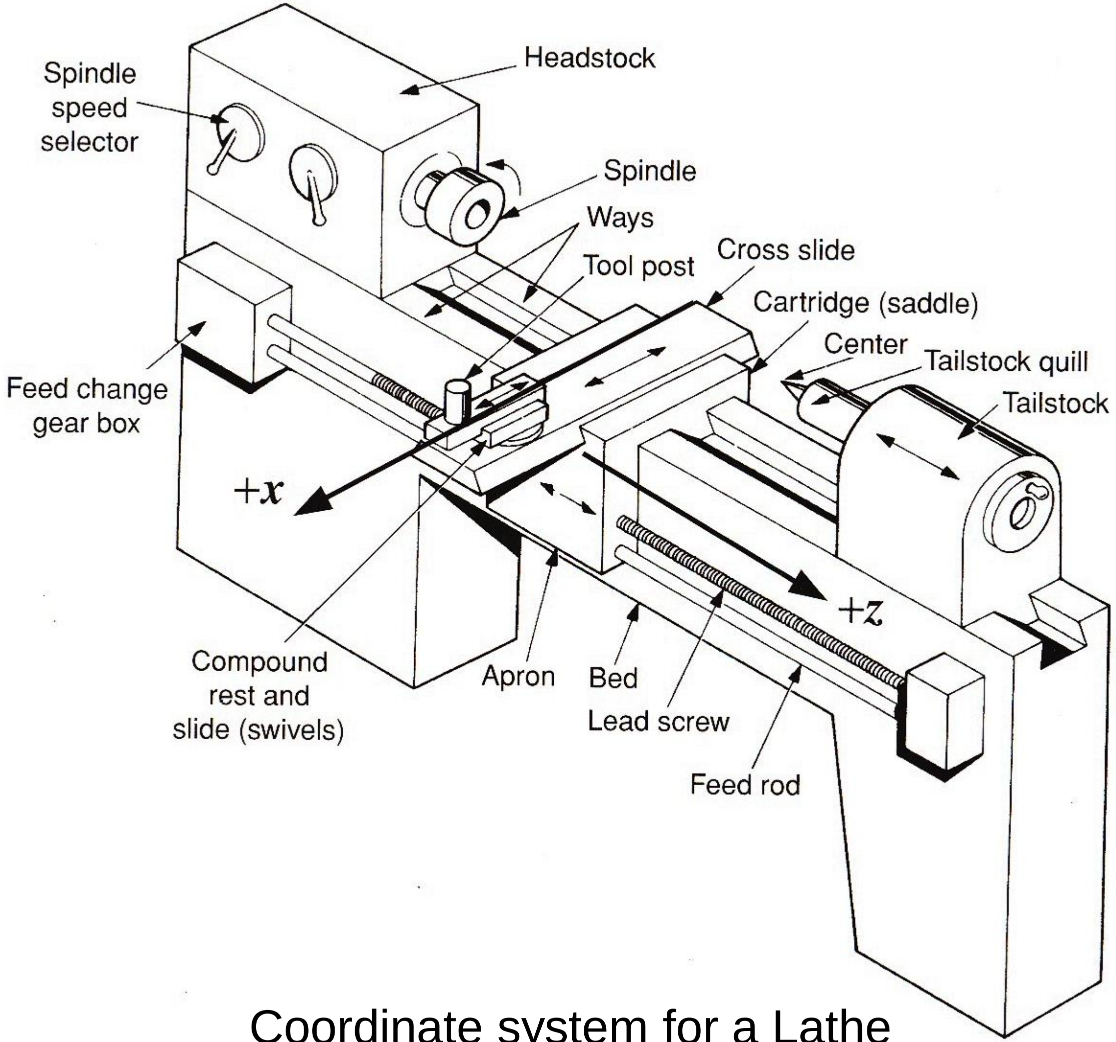
Horizontal milling machine



Vertical milling machine

CNC machines milling machines can perform simultaneous linear motion along the three axis and are called **three-axes machines**.

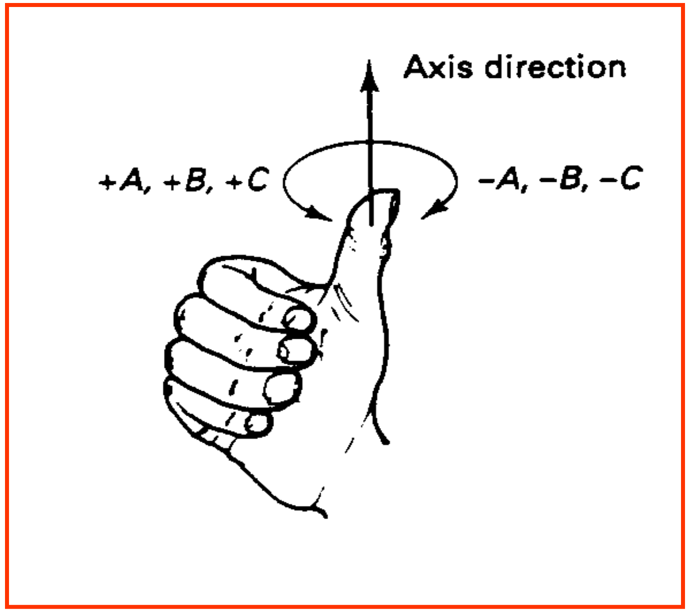
CNC Machine Axes of Motion

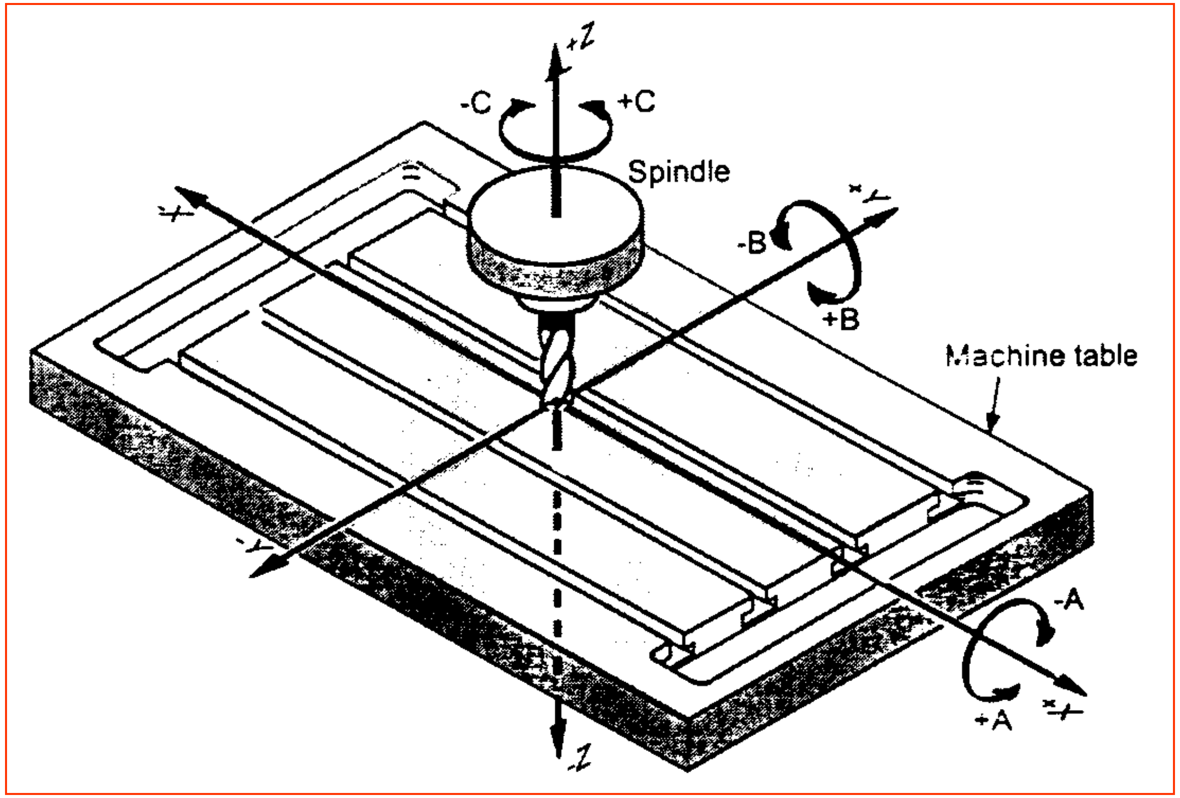


Coordinate system for a Lathe

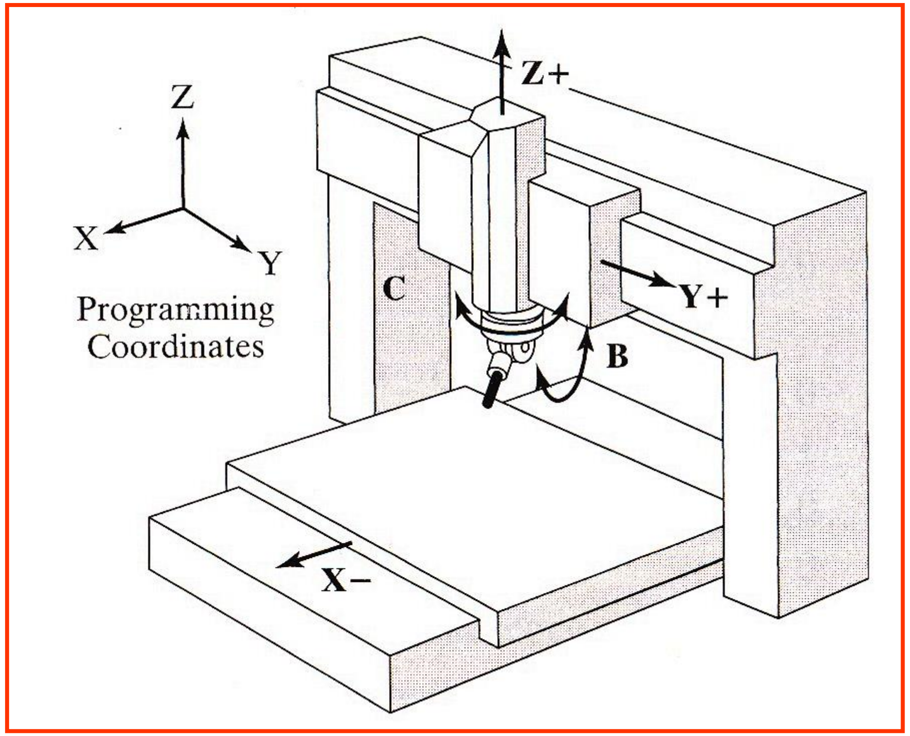
CNC Machine Axes of Motion

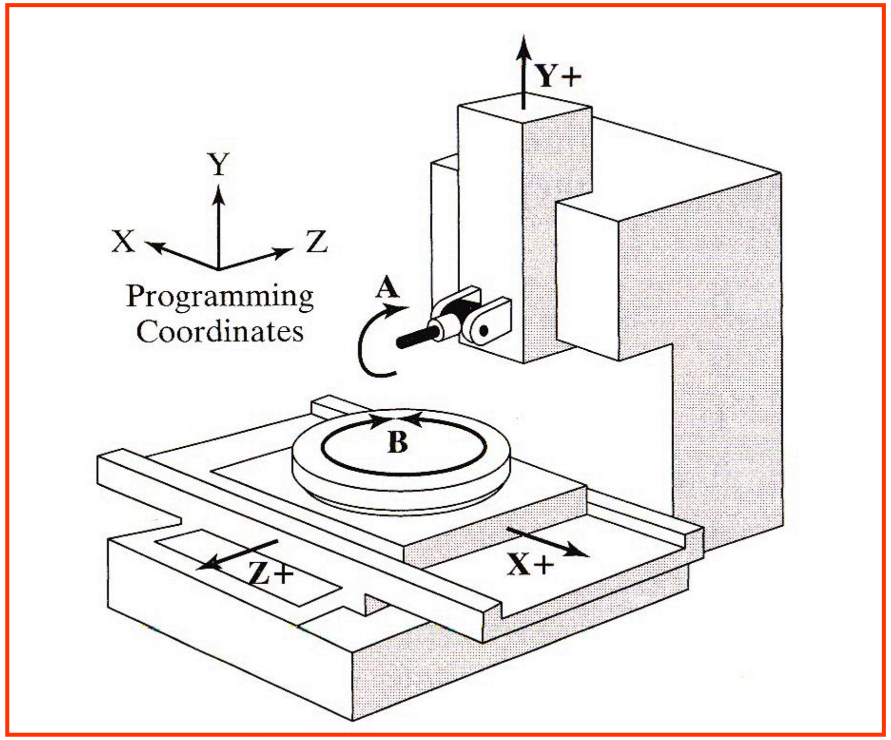
More complex CNC machines have the capability of executing additional rotary motions (4th and 5th axes).



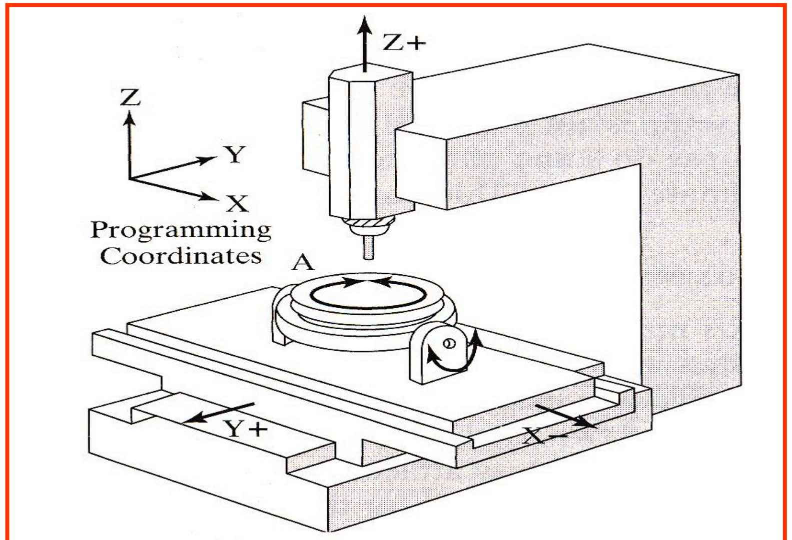


CNC Machine Axes of Motion



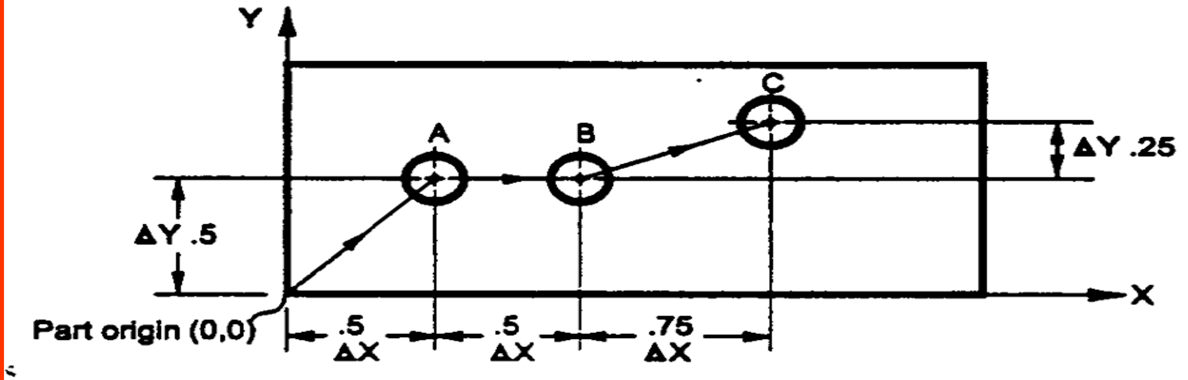


Five-axis machine configurations

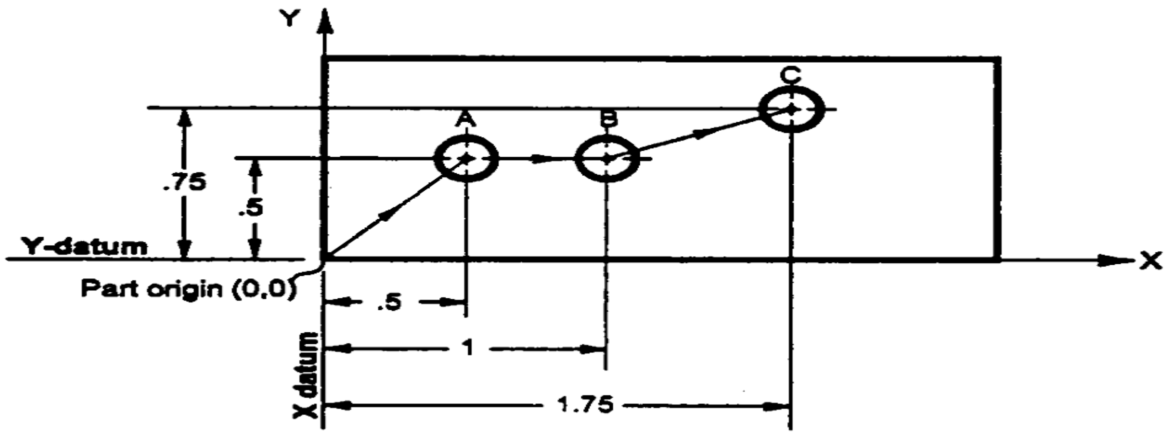


CNC Machine Tool Positioning Modes

Within a given machine axes coordinate system, CNC can be programmed to locate tool positions in the following modes; incremental, absolute, or mixed.



Tool position	Location	
	ΔX	ΔY
A	.5	.5
B	.5	0
C	.75	.25



Tool position	Location	
	ΔX	ΔY
A	.5	.5
B	1	.5
C	1.75	.75

Example of a part program

N001 G91 (incremental)
N002 G71 (metric)

Loading tool

Rapid motion

Tool change

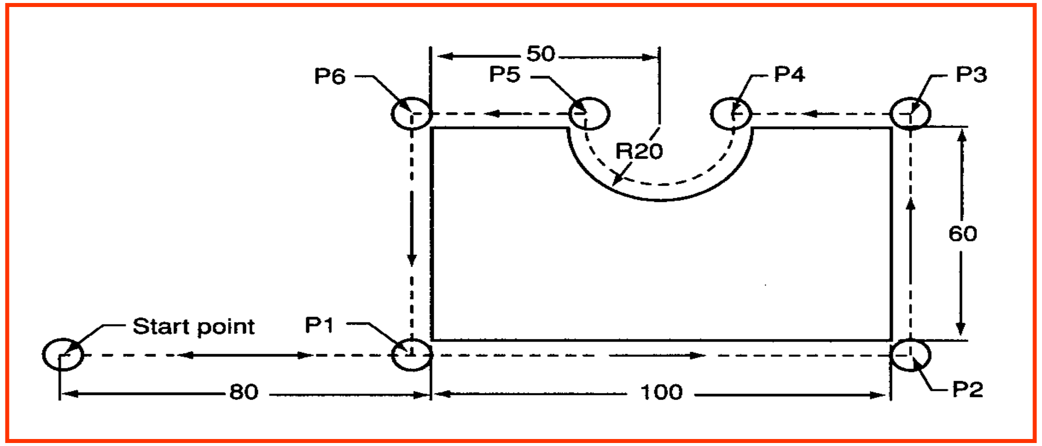
N003 G00 X0.0 Y0.0 Z40.0 T01 M06

Start spindle
Start coolant

Positioning tool at P_1

N004 G01 X75.0 Y0.0 Z-40.0 F350 M03 M08

Linear interpolation



Example of a part program

Moving tool from P_1 to P_3 through P_2

N005 G01 X110

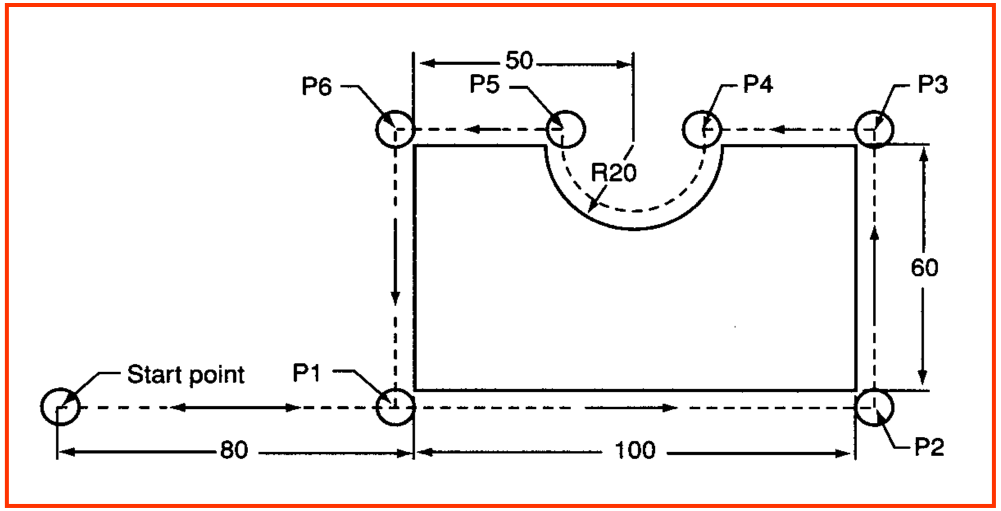
N006 G01 Y70.0

Moving tool from P_3 to P_4 along a straight line and from P_4 to P_5 clockwise along circular arc.

N007 G01 X-40.86

N008 G02 X-28.28 Y0.0 I-14.14 J-5.0

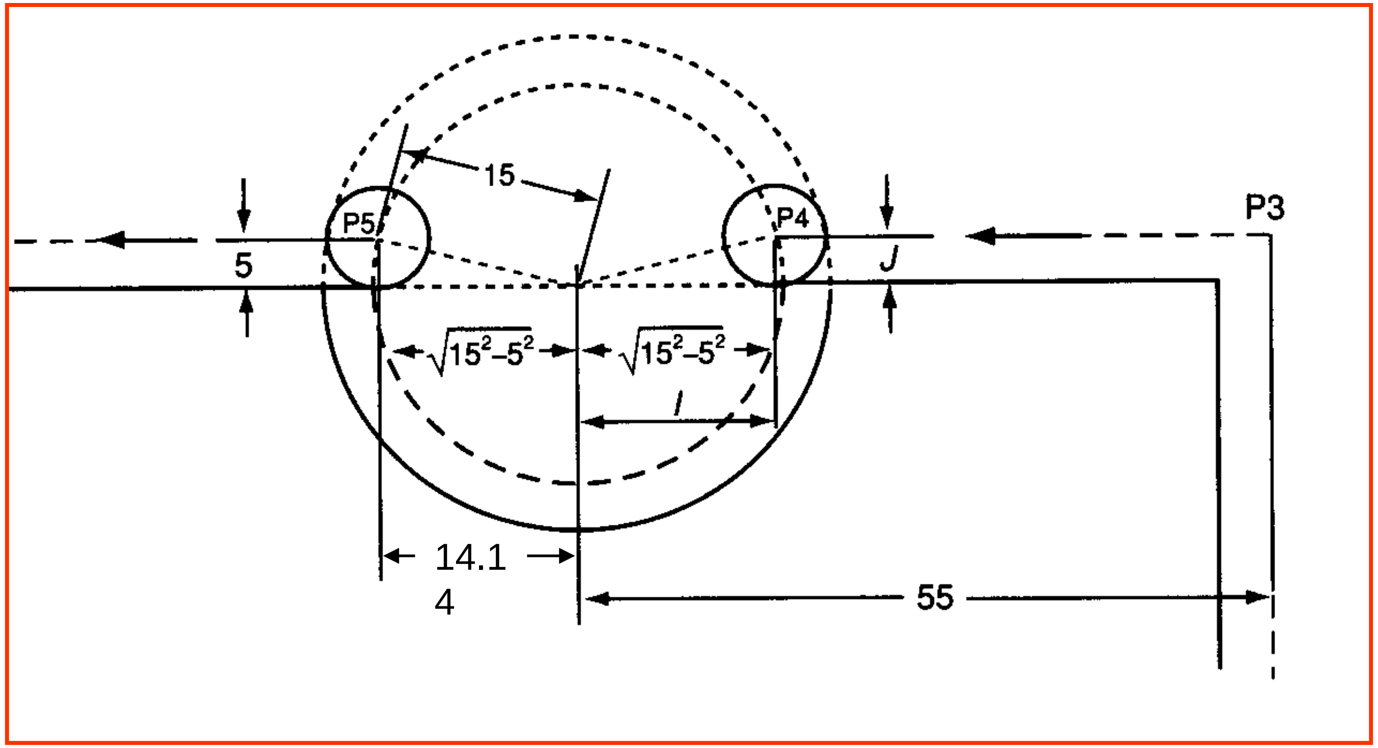
Tool dia.=10 mm



Example of a part program

X and Y specify the end point of the arc (P5) with respect to the start point (P4).

I and J specify the center of the arc with respect to the start point.



Computer-Assisted Part Programming:

Automatically Programmed Tools (ATP) language is the most comprehensive and widely used program. The language is based on common words and easy to use mathematical notations

- Identify the part geometry, cutter motions, speeds, feeds, and cutter parameter.
- Code the above information using ATP.
- Compile to produce the list of cutter movements and machine control information (Cutter Location data file, CL).
- Use post-processor to generate machine control data for a particular machine. This is the same as NC blocks.

Part Programming from CAD Database
"Integrated CAD/CAM Systems"

- In an integrated CAD/CAM system, the geometry and tool motions are derived automatically from the CAD database by the NC program (Pro/E, Unigraphics, ….)

- No need for manual programming or using APT language.

Integrated CAD/CAM System

- CAD and Cam (Computer Aided Manufacturing) together create a link between product design and manufacturing.
- The CAD system is used to develop a geometric model of the part which is then used by the CAM system to generate part programs for CNC machine tools.
- Both CAD and CAM functions may be performed either by the same system or separate systems in different rooms or even countries.
- Extending the connection between CAD and CAM to its logical limits within a company yields the concept of the computer-integrated enterprise (CIE). In CIE all aspects of the enterprise is computer aided, from management and sales to product design and manufacturing.

CAM:

List Of Experiments

i) Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning operations.

ii) Part programming for Point to point motions, Linear motions, Circular interpolation, Contour motion, Pocket milling - Circular, Rectangular and Mirror commands.

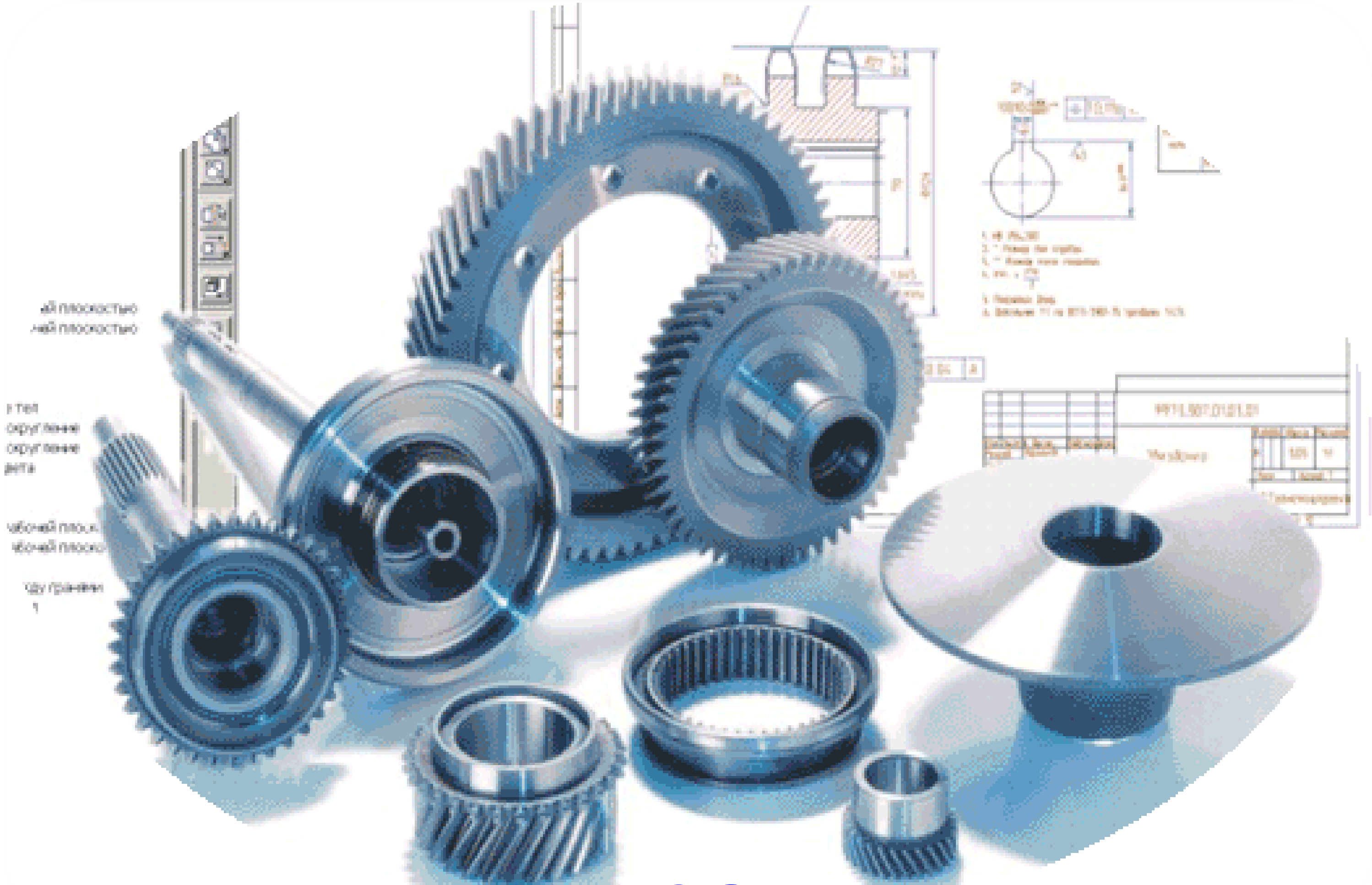
iii) Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning, Thread cutting.

iv) Generation of tool path, NC part program and its simulation.

v) Machining of small components using CNC Lathe, CNC Mill and CNC Turning center.

Softwares: ***CNC Offline Simulation, EdgeCAM***

5. CAD LABORATORY



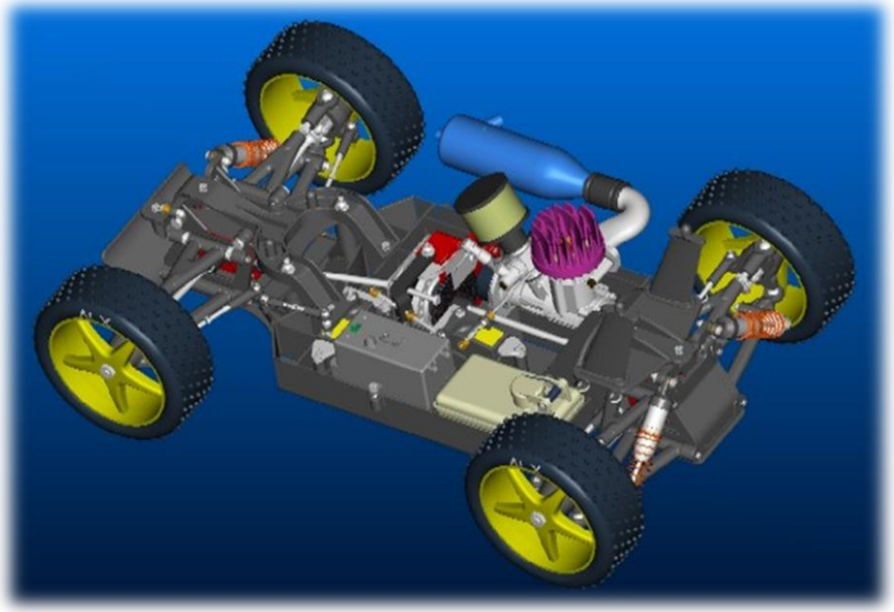
WELCOME

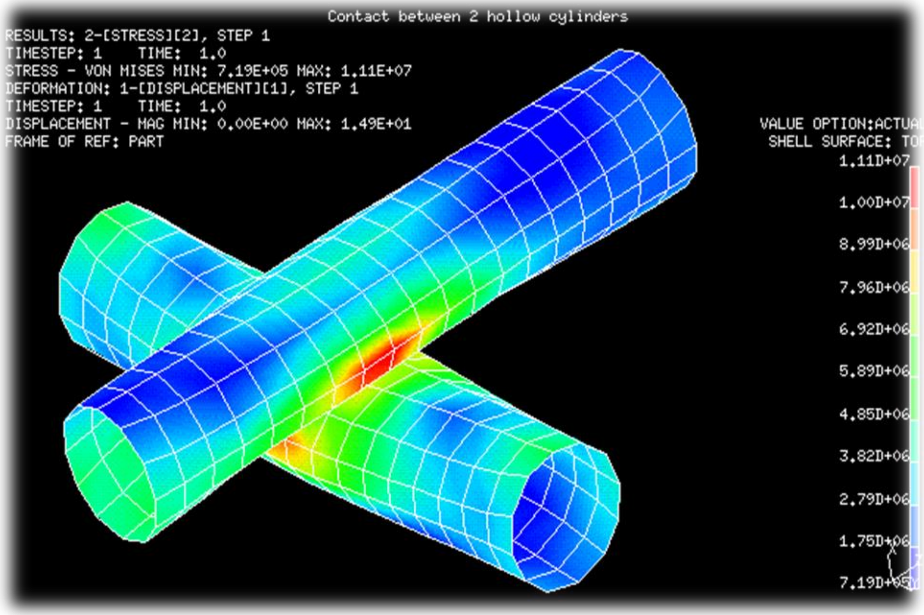
TO

CAD LABORATORY

VNR LAB PROTOCOL

CAD LABORATORY





PURPOSE OF THE LABORATORY

- This lab is to primarily facilitate students to evolve concepts and convert it into a complete product.
- The process of design, analysis and simulation takes place in a digitally integrated environment.

1. LEARNING OBJECTIVES

- Understand the ways in which 2D, 3D, part drawings and assembly drawings are made using appropriate CAD packages.
- Understand the determination of stresses and strains in systems like trusses and beams.

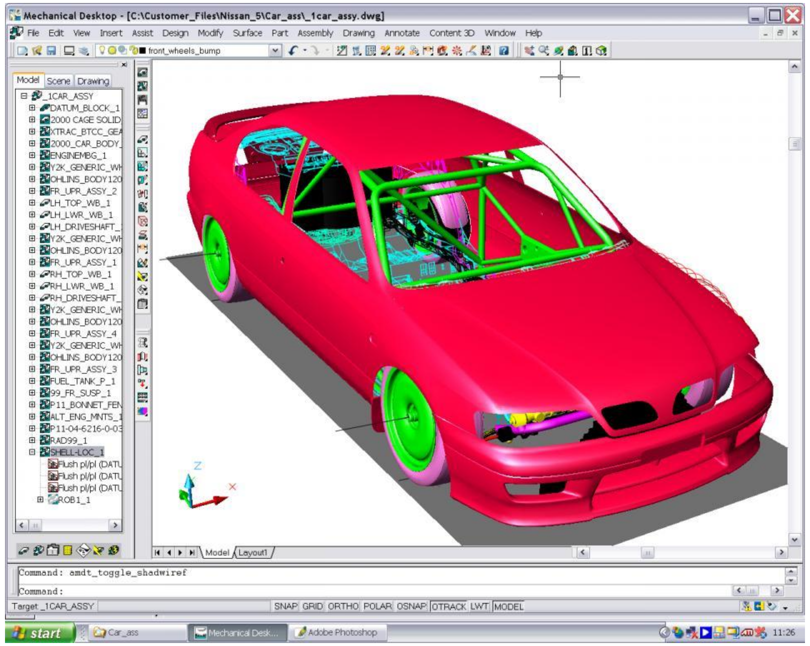
LEARNING OUTCOMES

- Students will be able to:
  - Produce part and assembly drawings using CAD packages.
  - Determine the stress, strain and elastic properties in components of the structures.

WHAT WILL WE STUDY IN THIS LAB?

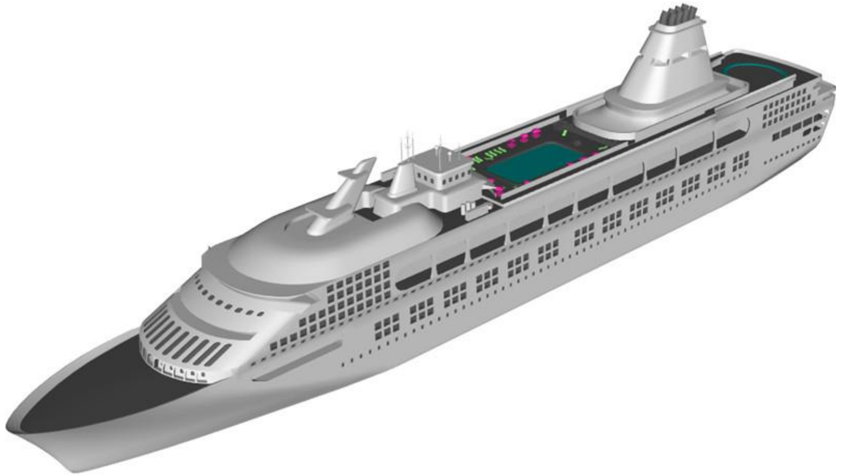
- **Computer Aided Design**
- **Computer Aided Engineering**

2. Bringing in the real world situation

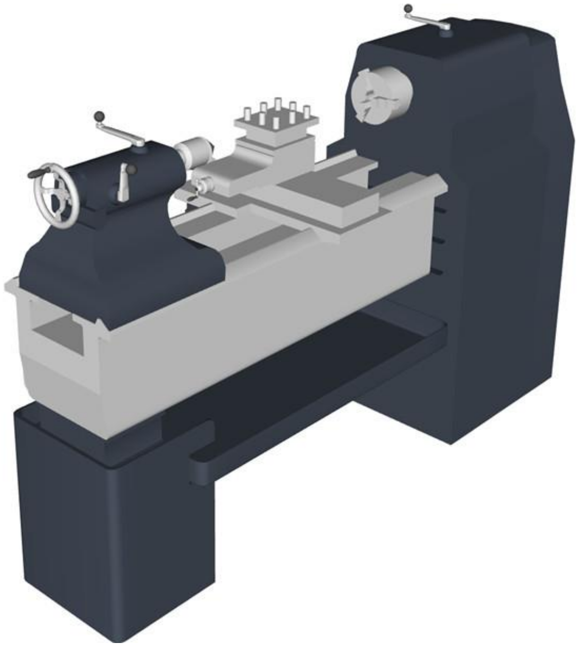


2. Bringing in the real world situation

2. Bringing in the real world situation



2. Bringing in the real world situation



2. Bringing in the real world situation

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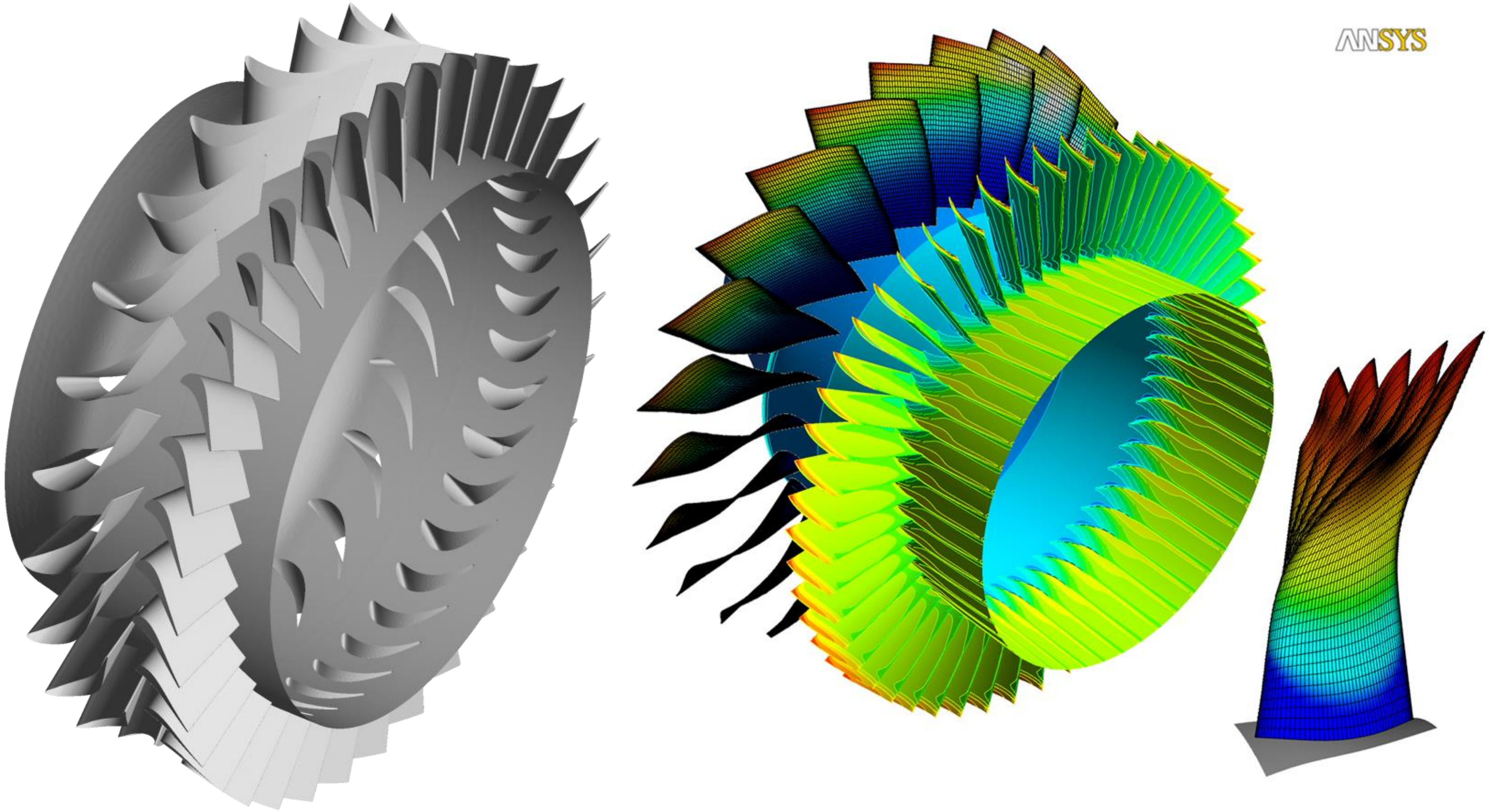

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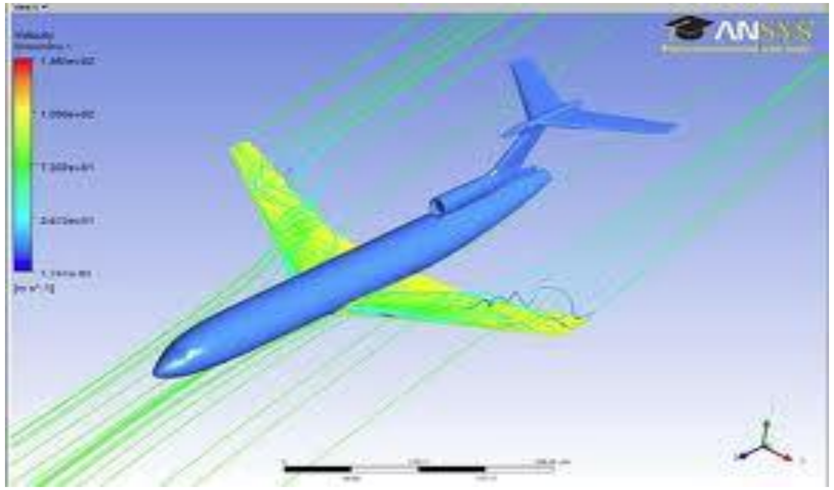
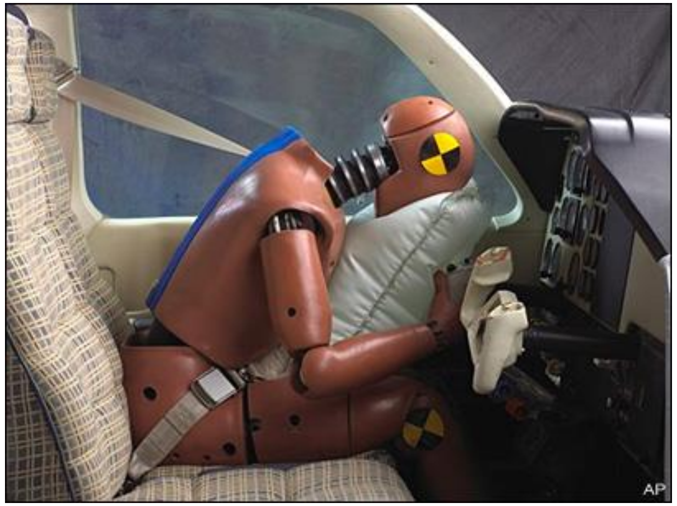
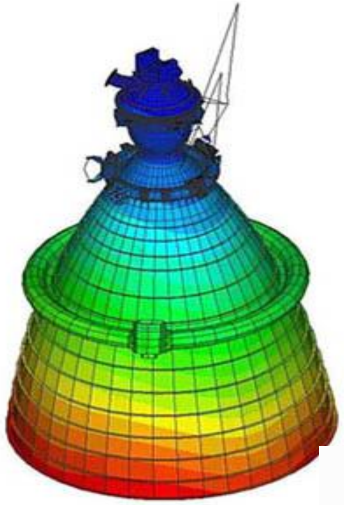
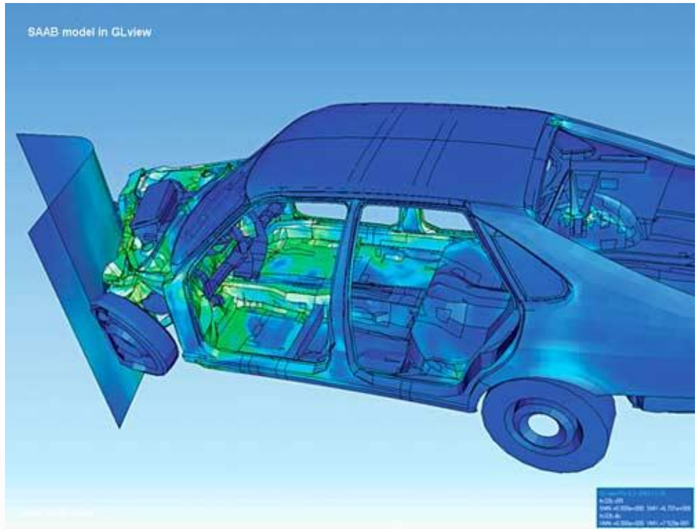
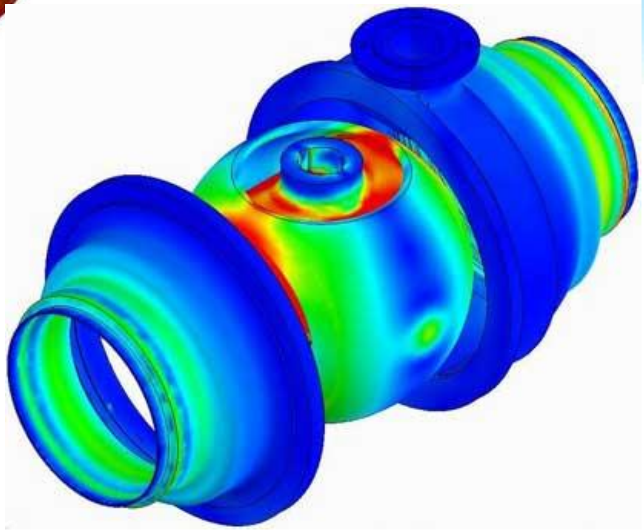




2. Bringing in the real world situation







2. Bringing in the real world situation

Simulation of Mechanical Showel

Simulation of Su-33 Fighter

3. Fitting into the spectrum

- Increase the Productivity
  - Better visualization
  - Reduced time & effort
- Improve the Quality
  - Reduced design errors
  - Greater accuracy

3. Fitting into the spectrum

Improve The Communications

- Standardized Drawings
- Fewer Drawing Errors
- Greater Legibility
- Better Documentation

Create Database For Manufacturing

- Database Like
- Geometries And Dimensions
- Material Specifications
- Bill Of Materials

4. Keywords Identified

- Design Process
- Synthesis
- Analysis and optimization
- Evaluation
- Presentation
- Manufacturing

5. Linking keywords with concepts

- Computer Aided Design
- Geometric Modeling
- Engineering Analysis
- Design Review And Evaluation
- Drafting
- Computer Aided Manufacturing

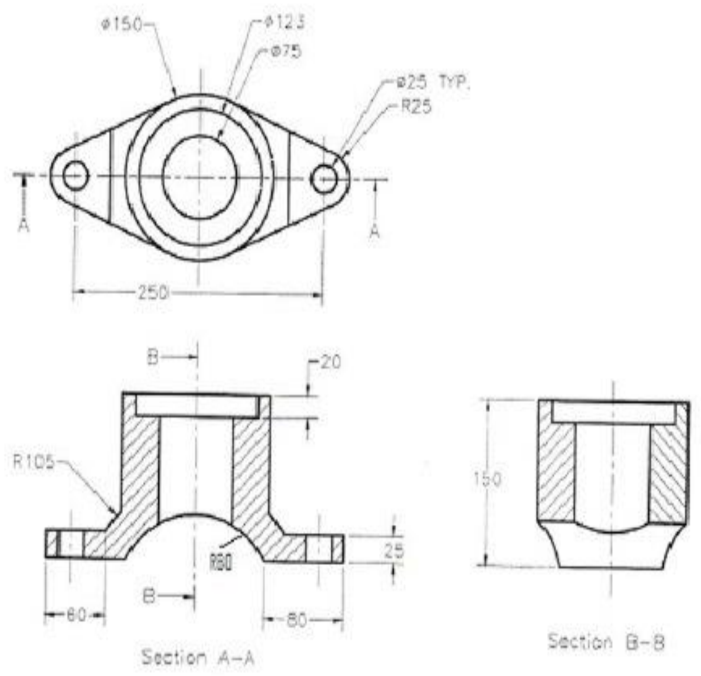
6. Generation of exercises

- 2D Drawing using sketcher workbench
- 3D Part modeling using 3D features
- Assembly modeling
- Drafting
- Surface modeling
- Sheet metal working
- Analysis

7. Focusing on problem/exercise

- Design and analysis of a given mechanical component

8. Design of exercise to solve the problem



- To study the given drawing in detail
- To prepare a 2D sketch using suitable commands by considering symmetricity of the part
- To prepare a 3D model of the part using appropriate features like Extrude, Revolve, Hole etc.
- To obtain a drafted view showing all the dimensions, sections, etc.
- To analyze the part by applying the loads at appropriate places.

9. VERIFICATION

- To verify the sketches as per the given data.
- To verify the loads, boundary conditions and other details as per the data.

10. CONFIRMATION

- To compare the drafted views and 3D model with the given drawing.
- To verify the results obtained by analyzing the component with the theoretical or historical results.

11. CONCLUSIONS

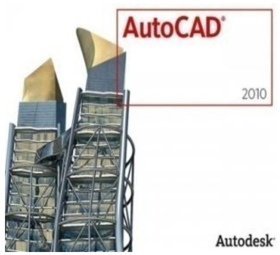
- 2D sketches of the given part are drawn
- 3D model of the same is created.
- Drafted views of the model are obtained.
- Model is analyzed for the stresses induced.

Facilities in the lab

List of softwares

- CAD:

CREO PARMETRIC 2.0 50 Seat Network License



Auto-CAD 2015 - 250 Seat Network License

List of softwares

- CAE:

ANSYS – 5 Seat Network License

List of hardware

- Computer systems:

HP Workstations – 75 Nos.

IBM Server – 1 No.

List Of Hardware

➢ Peripheral Devices:

HP Multi Function Printer – 1 No.

Infocus LCD Projector– 1 No.

Please Note…

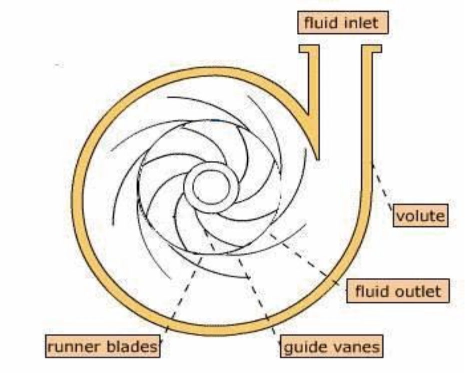
ENTRY INTO LABORATORY

- On Time
- With Laboratory Record
- With observation notebook
- With Identity Card

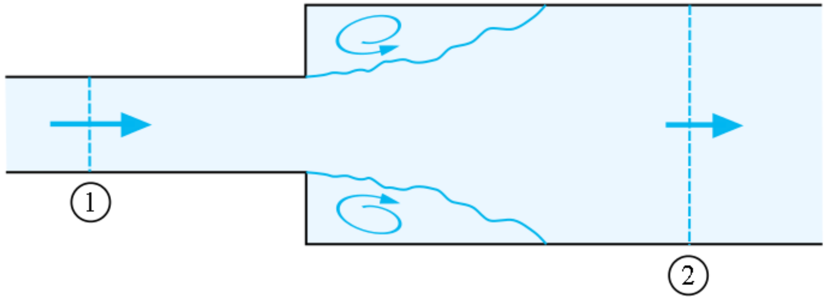
6. FLUID MECHANICS
& HYDRAULIC MACHINERY LABORATORY


WELCOME
TO
FLUID MECHANICS
&
HYDRAULIC MACHINERY
LABORATORY

VNR PROTOCOL FOR LABORATORIES



Fluid Mechanics
&
Hydraulic Machinery



Prepared by R.RAMU

LEARNING OBJECTIVES

To introduce the student the fundamental theories and the industrial applications of fluid mechanics and hydraulic machines

WHAT WILL WE STUDY IN THIS LABORATORY

What Will We Study In This Laboratory

PURPOSE OF THIS LABORATORY

To give practical understanding of the theoretical concepts taught in the class, by conducting the experiments as a part of B. Tech. Course as per the JNTU Curriculum for the following Engineering Branches

- Mechanical Engineering
- Automobile Engineering
- Civil Engineering
- Electrical & Electronics Engineering

- The purpose of this laboratory is to reinforce and enhance your understanding of the fundamentals of Fluid mechanics and Hydraulic machines.

- The experiments here are designed to demonstrate the applications of the basic fluid mechanics principles and to provide a more intuitive and physical understanding of the theory

The List of Experiments

1. Verification of Bernoulli’s Principle
2. Calibration of Venturi Meter
3. Calibration of V-Notch
4. Determination of Friction factor for a given Pipe Line
5. Determination of loss of head in different fittings in a pipeline
6. Impact of jets on Vanes

The List of Experiments

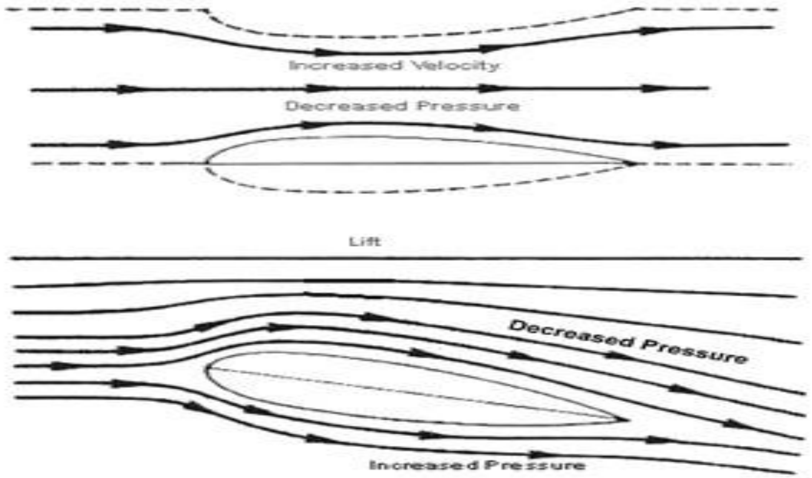
7. Performance Test on Pelton Turbine
8. Performance Test on Francis Turbine
9. Performance Test on Kaplan Turbine
10. Performance Test on Single Stage Centrifugal Pump
11. Performance Test on Multi Stage Centrifugal Pump
12. Performance Test on Reciprocating Pump

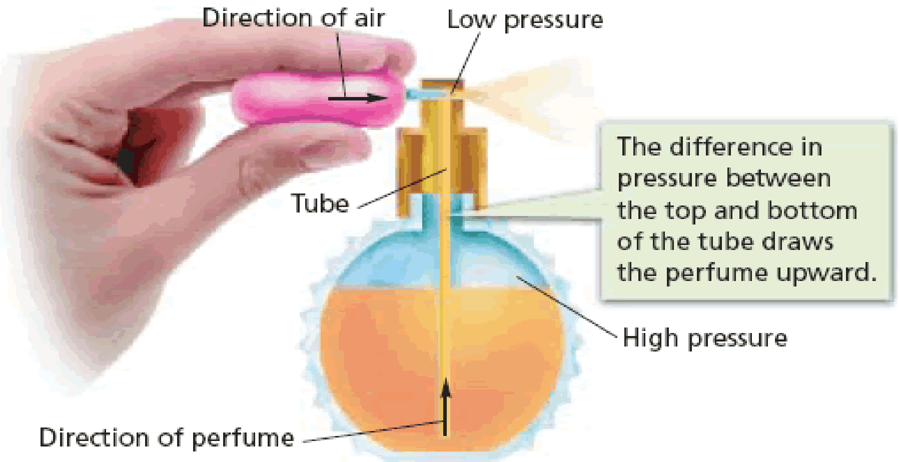
Lab Introduction Module

1. Fluid Flow Experiments
2. Hydro Power consuming Devices - Hydraulic Turbines
3. Hydro Power Producing Devices - Hydraulic Pumps

Cycle – I Fluid Flow Experiments

Bernoulli's Principle

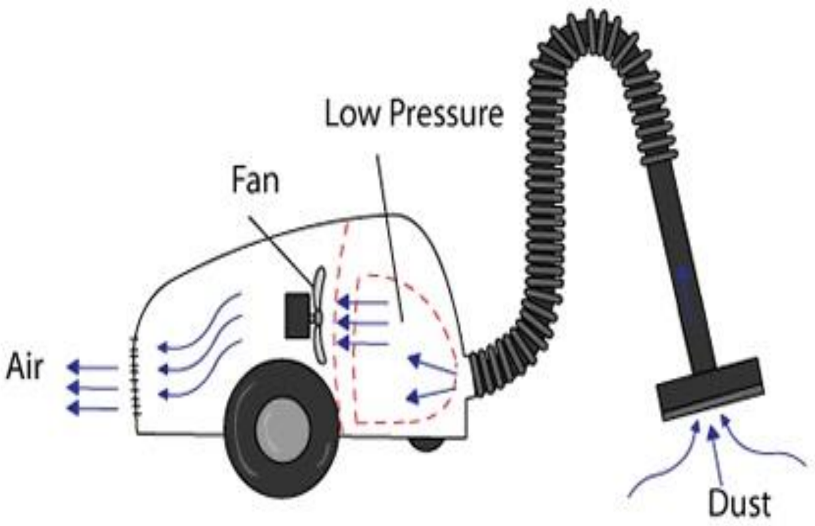


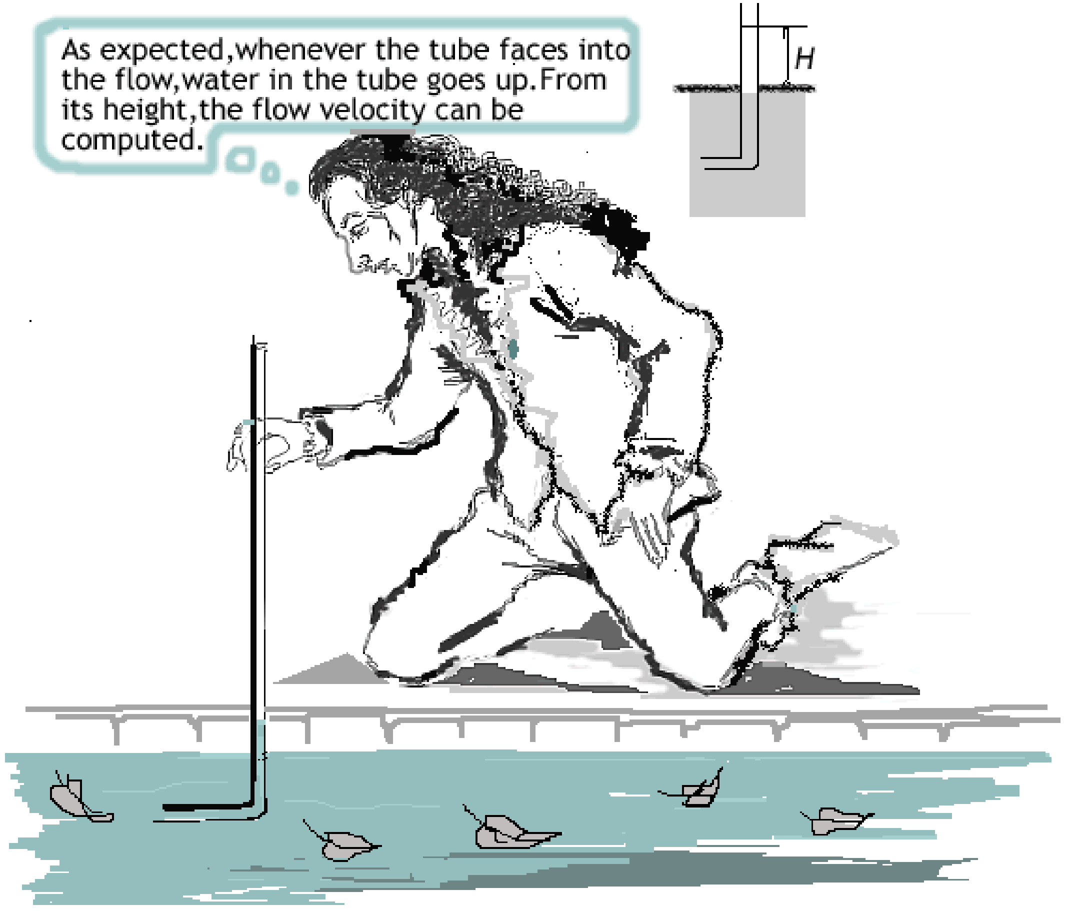


A **vacuum cleaner** is a device that uses an air pump (a centrifugal fan in all but some of the very oldest models), to create a partial vacuum to suck up dust and dirt, usually from floors, and from other surfaces such as upholstery and draperies.

Applications: homes as well as in industry.

vacuum cleaner

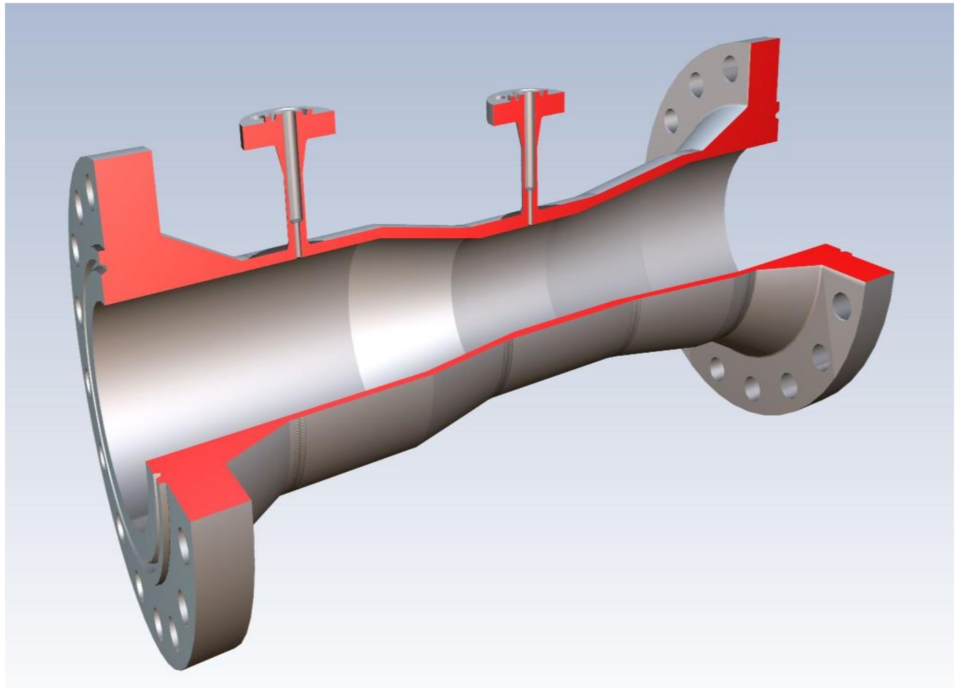




Pitot Tube

Venturi-Meter

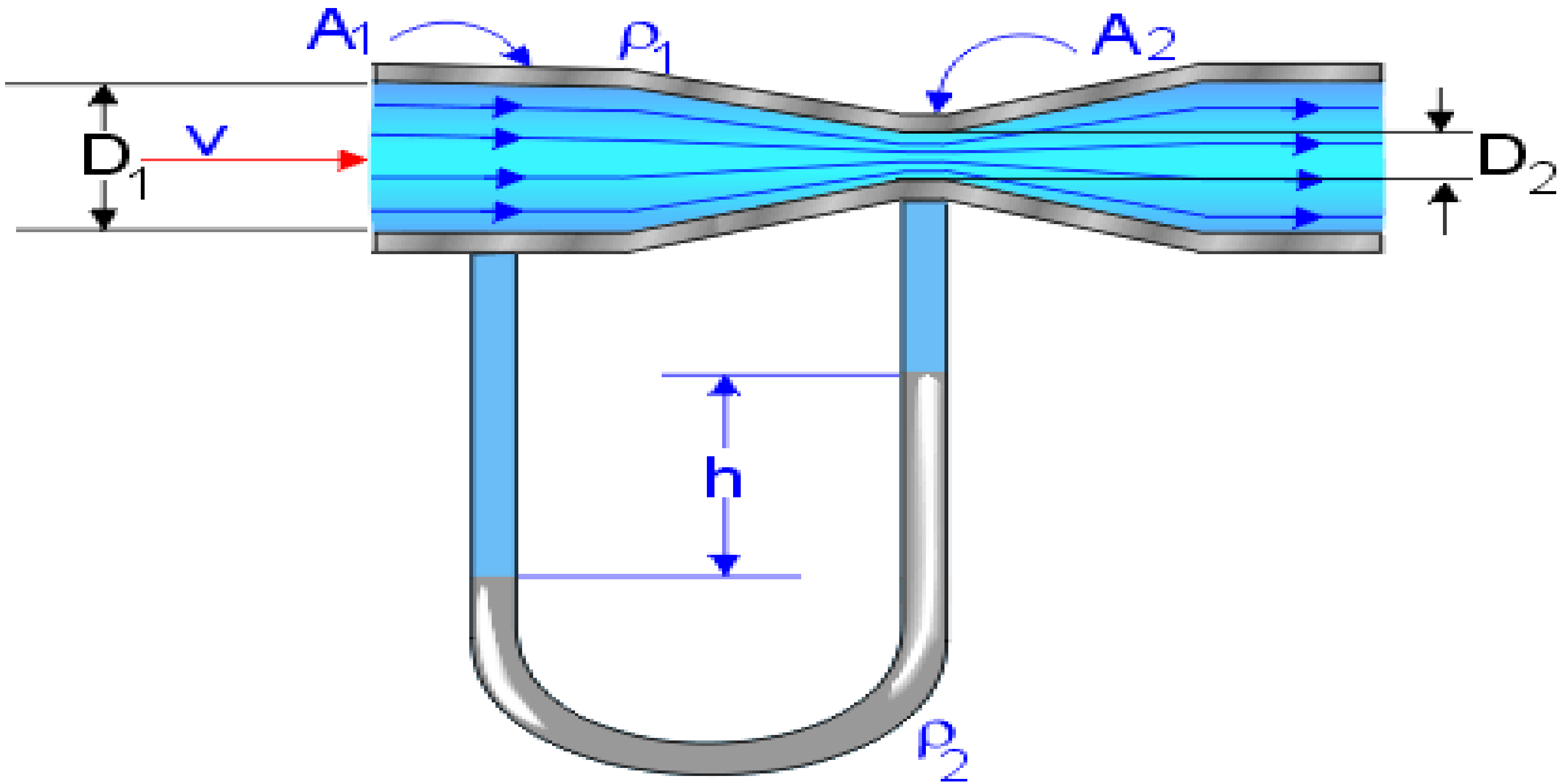
Venturi Meter is a device which is used to measure the discharge in the pipe flow



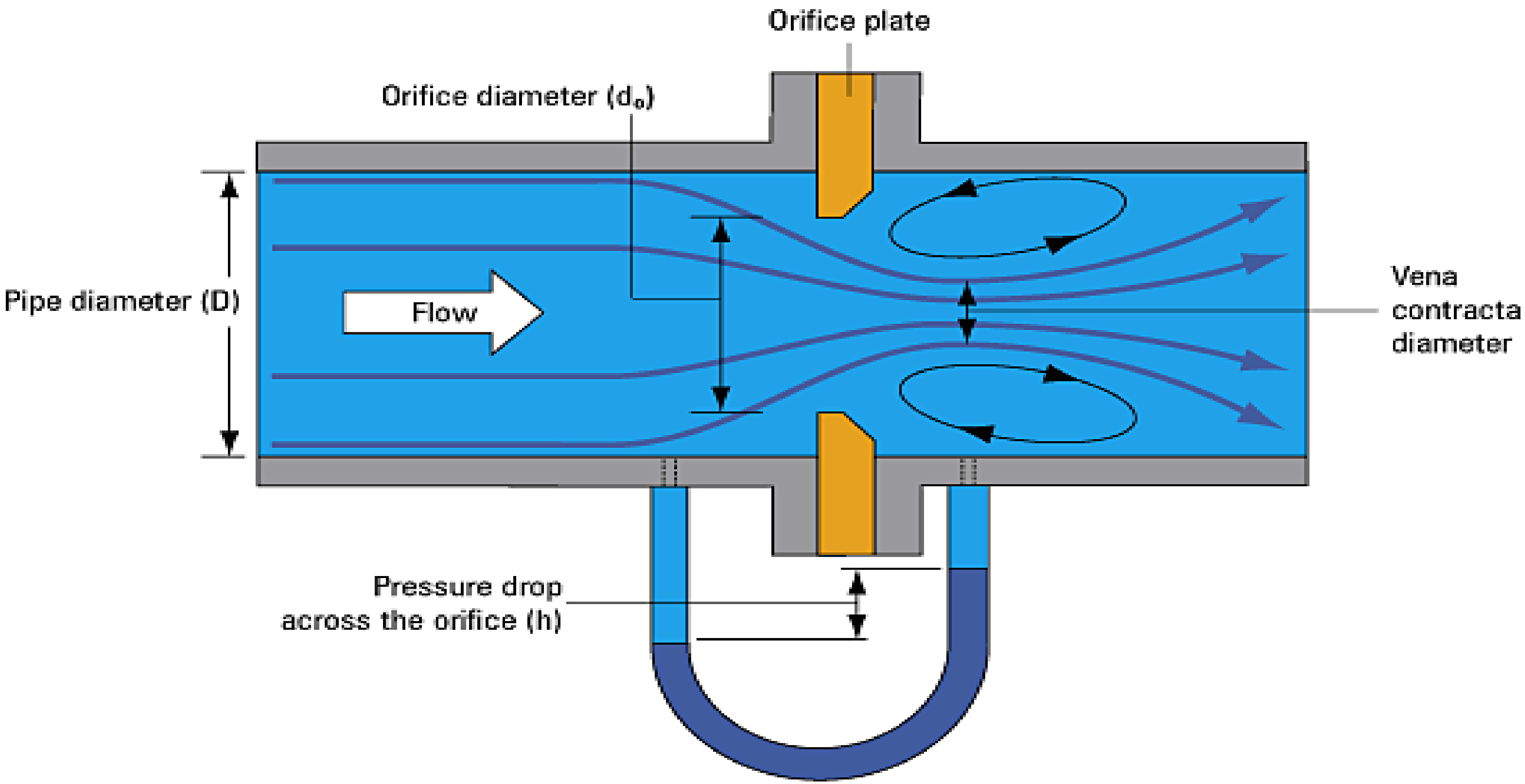
Applications:

- The Flow of Chemicals in Pipelines
- Flow in Carburetors
- Measurement Of Blood In Vessels
- Uses of venturi-Meter in industry

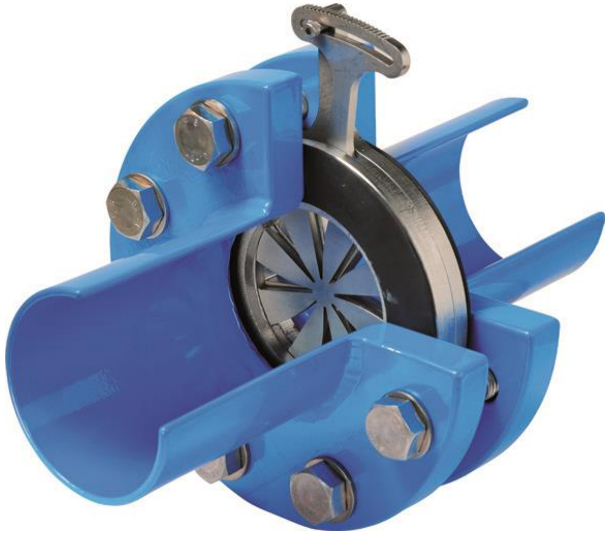
Venturi-Meter



Orifice-Meter



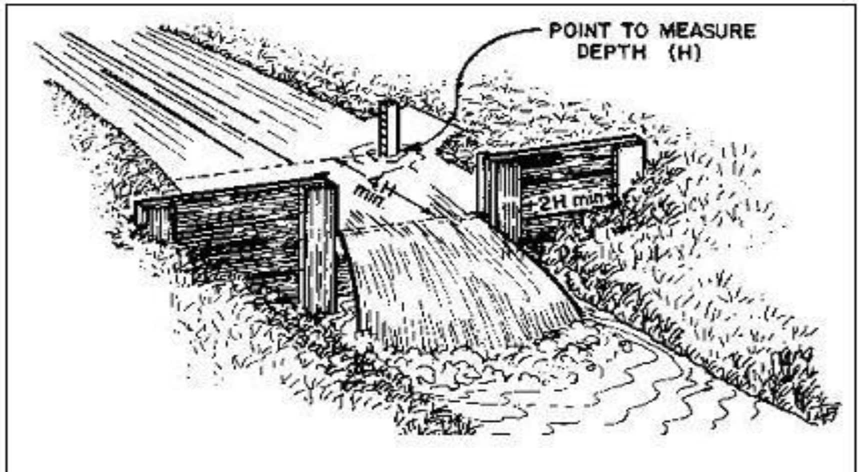
An Orifice-Meter is essentially a thin circular plate with a sharp edged concentric circular hole in it. It can used to meter lube oil, cooling water systems, and compressed air flow.



Orifice Meter is a device which is used to measure the discharge in the pipe flow

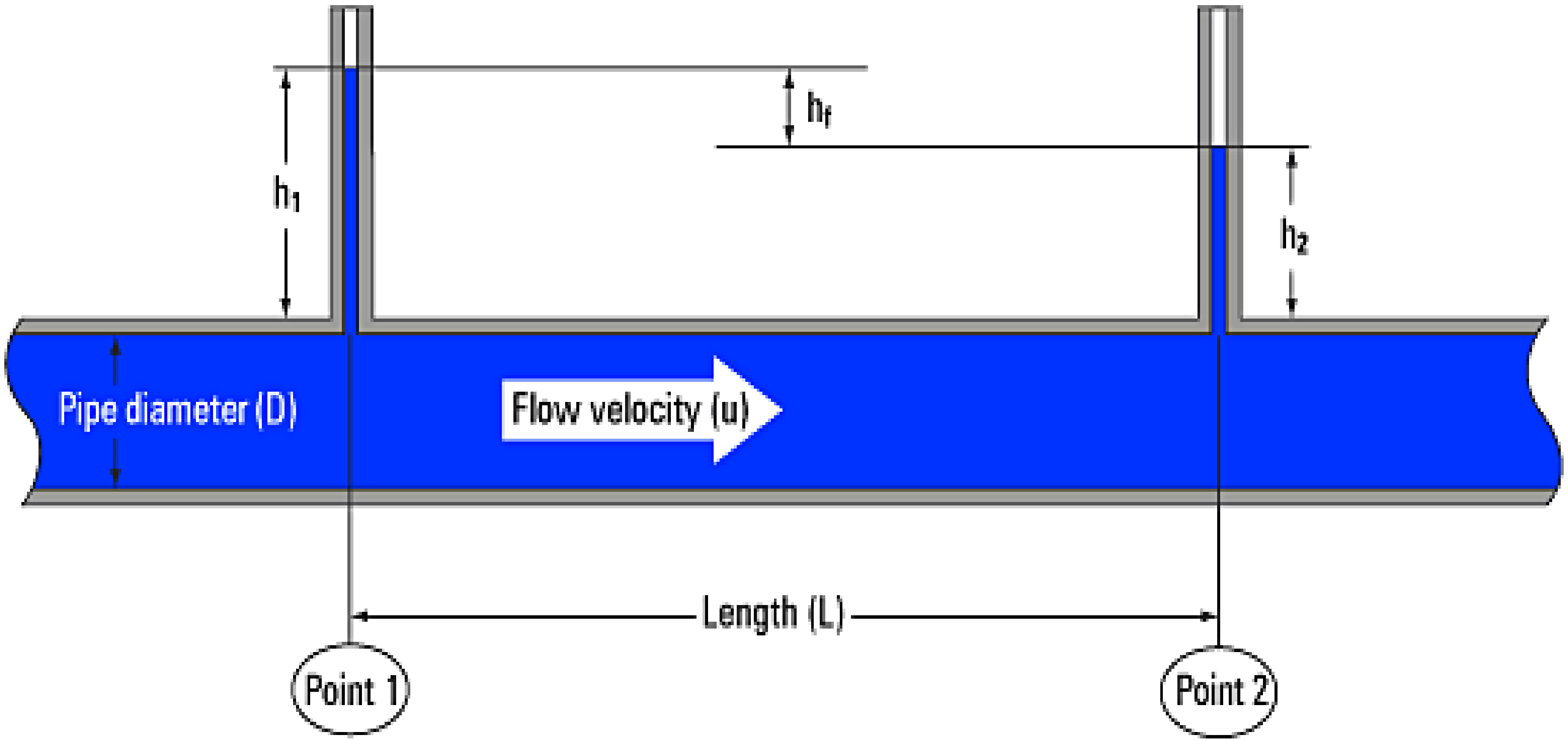
V Notch

The V-notch weir is a triangular channel section, used to measure small discharge values.

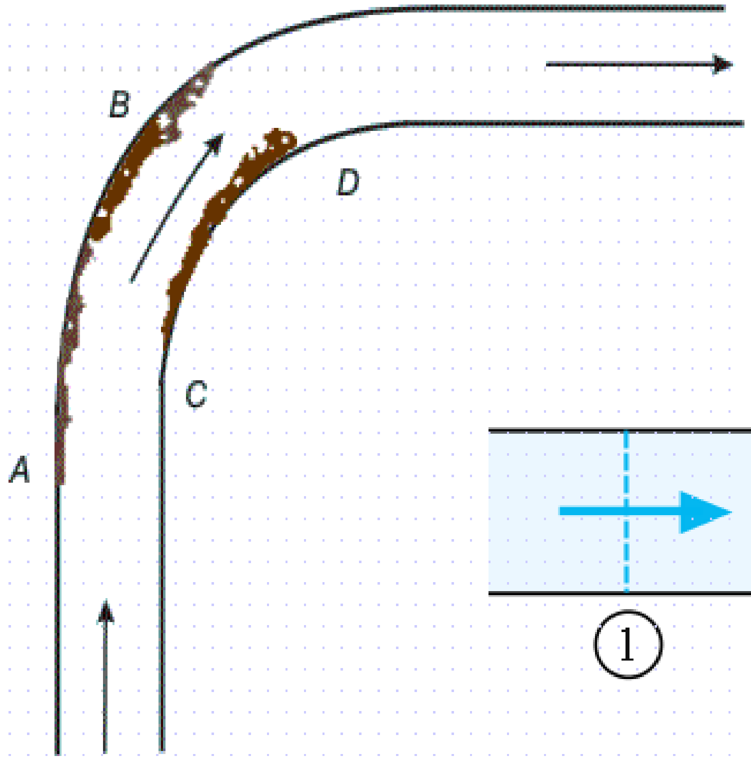


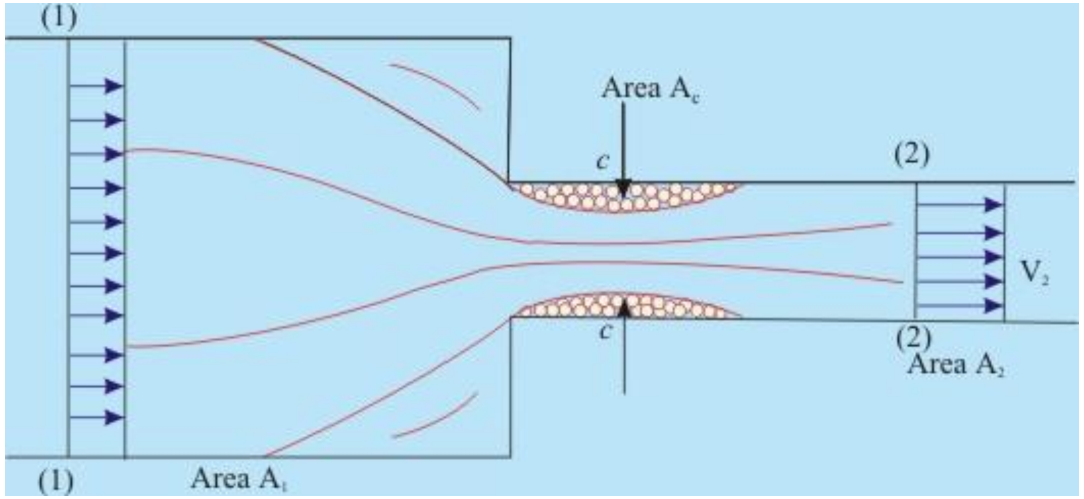
Rectangular, Sharp-Crested Weir

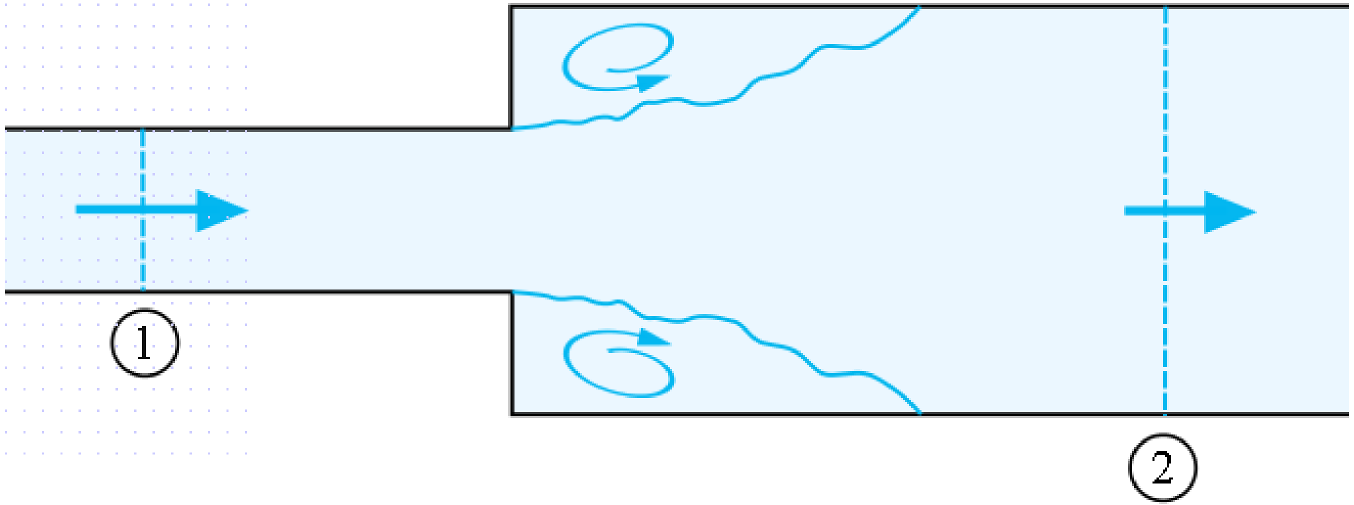
Pipe Friction



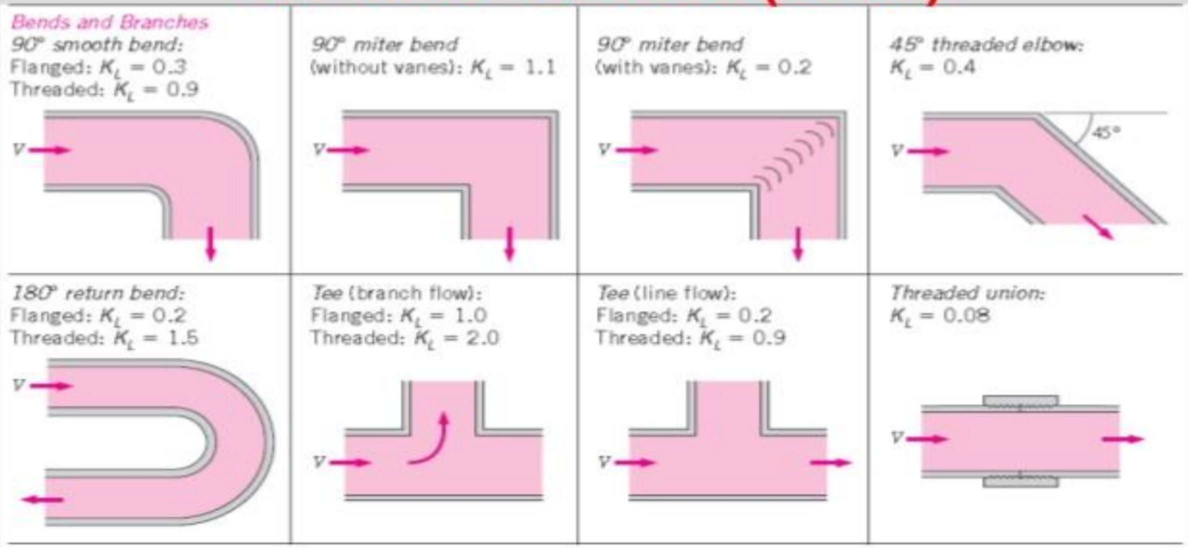
Pipe Fittings







5.2 Minor Losses (cont')

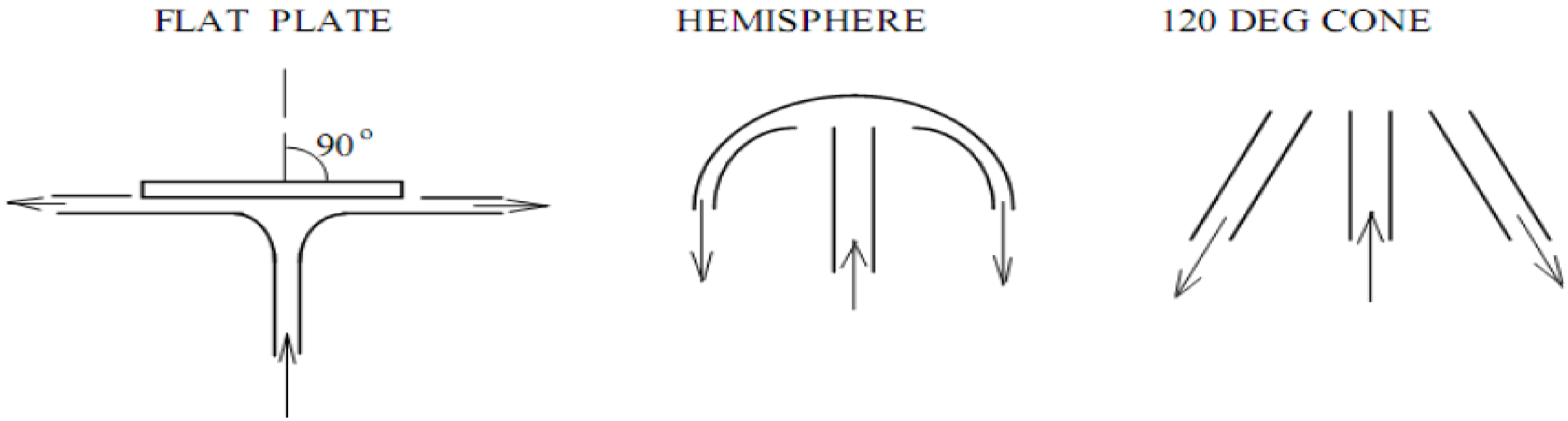


- These loss coefficient depends on the manufacturer data

Impact of Jet

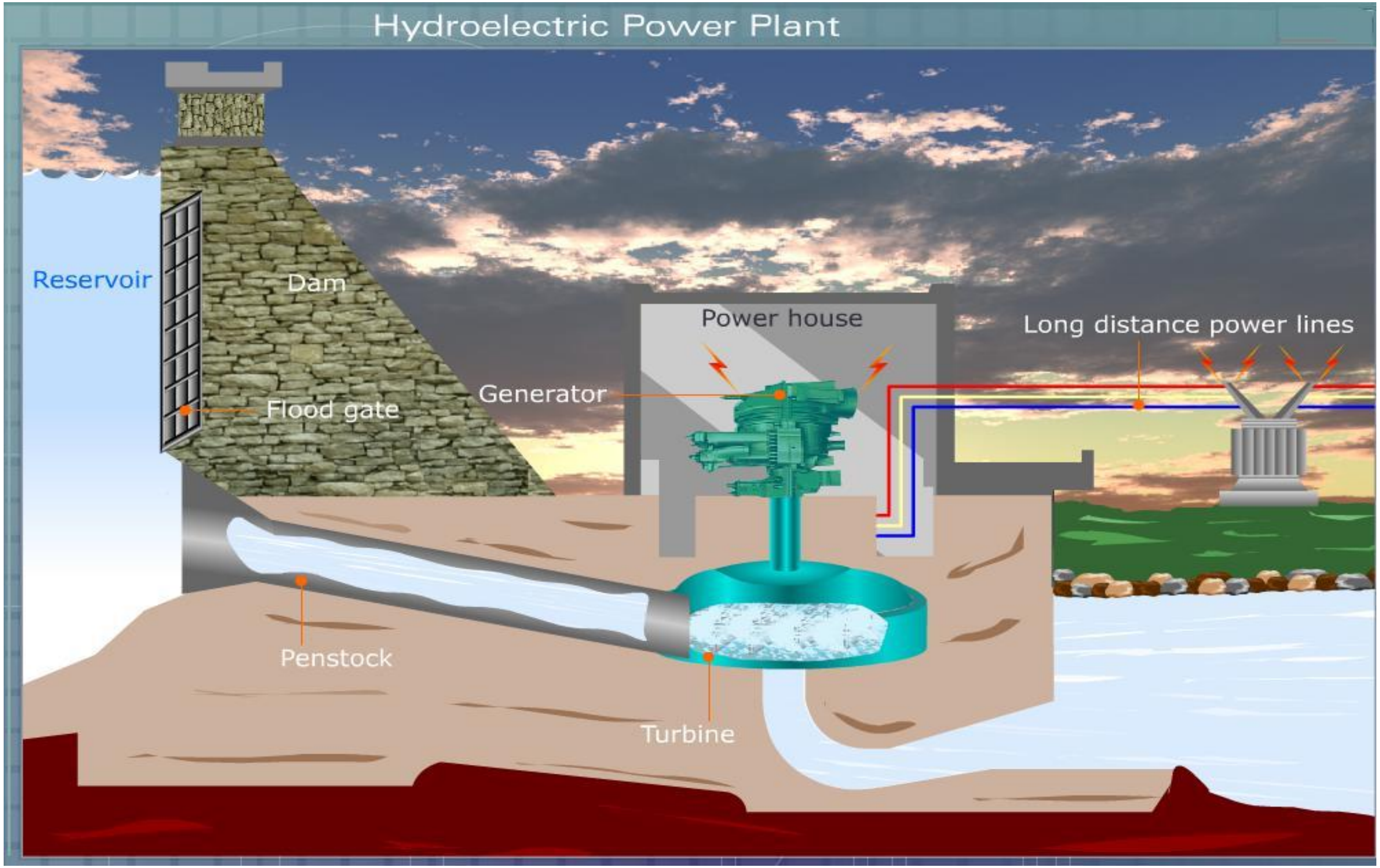
- In each case it is assumed that there is no splashing or rebound of the water from the surface

- Jet propulsion means propulsion or movement of the bodies such as ships, rockets, aircrafts , Hydraulic Machines, etc with the help of jet.

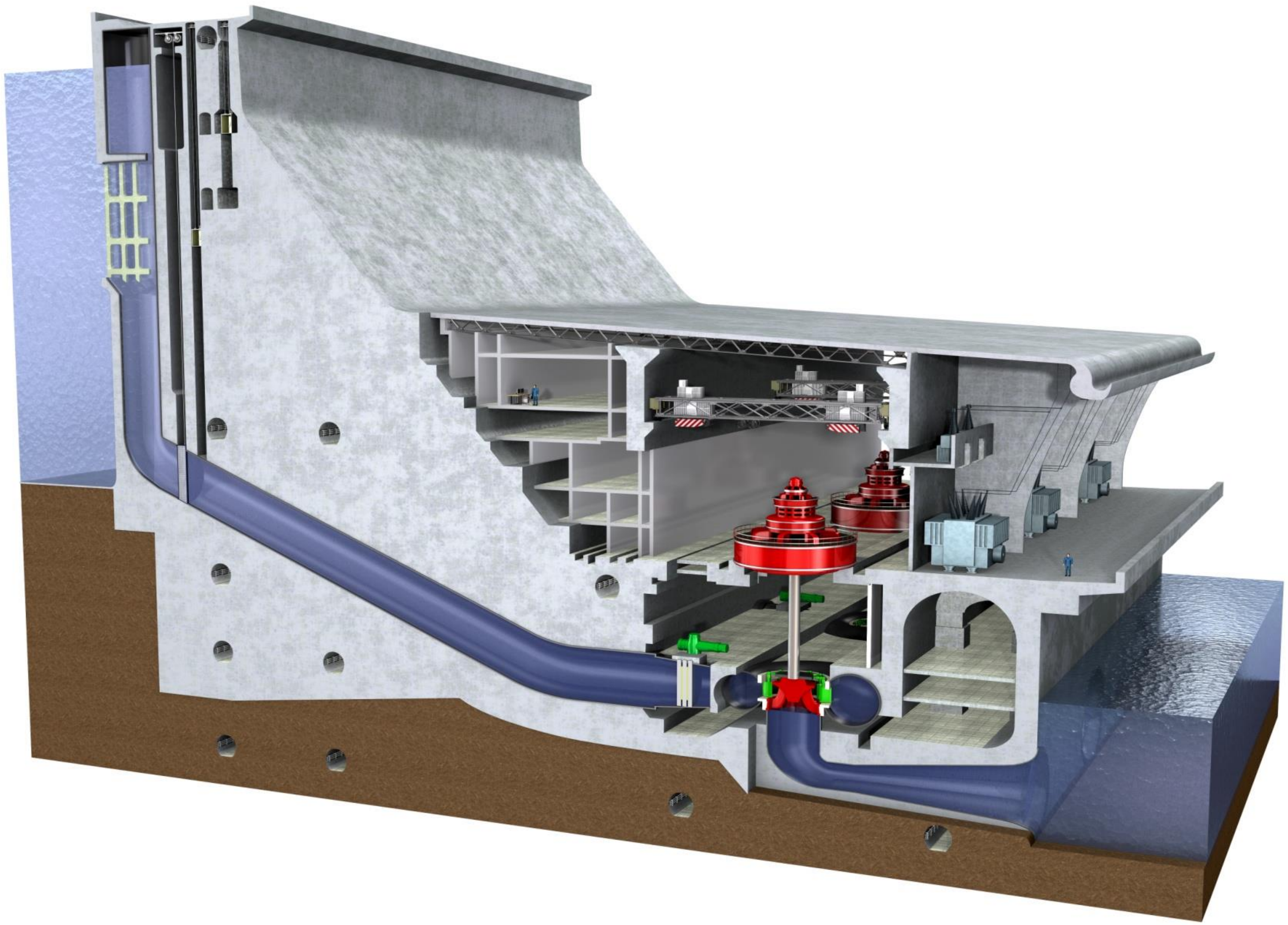


2nd Cycle Hydraulic Machines

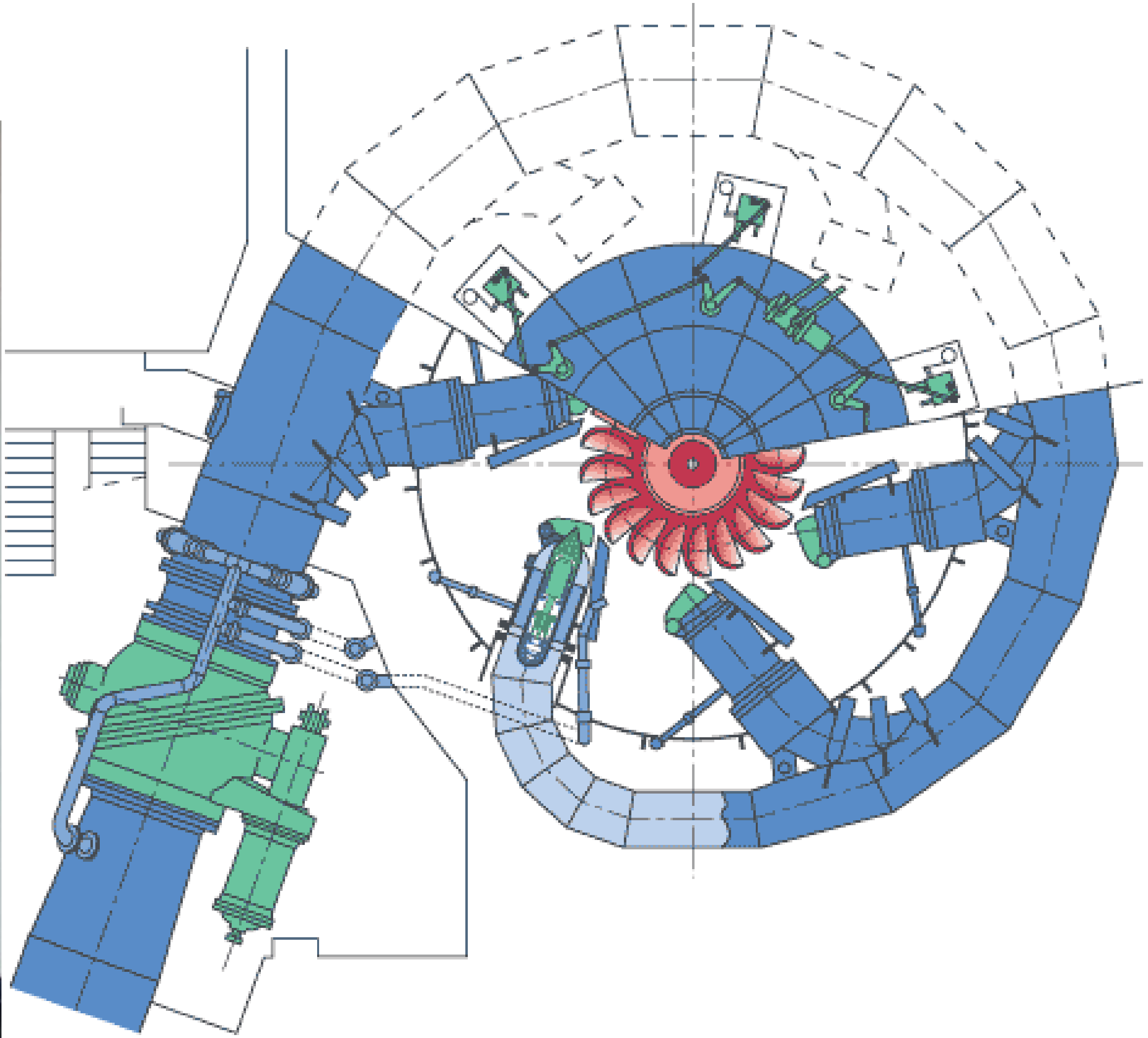
Hydraulic Electric power Plant



Hydraulic Electric power Plant



Pelton Turbine



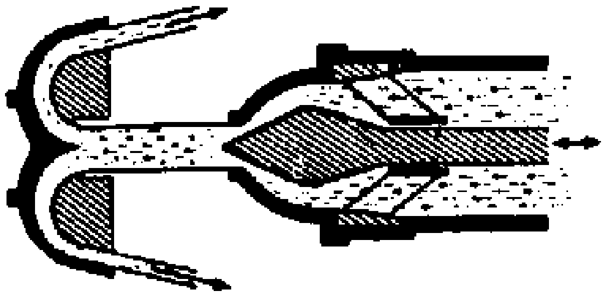
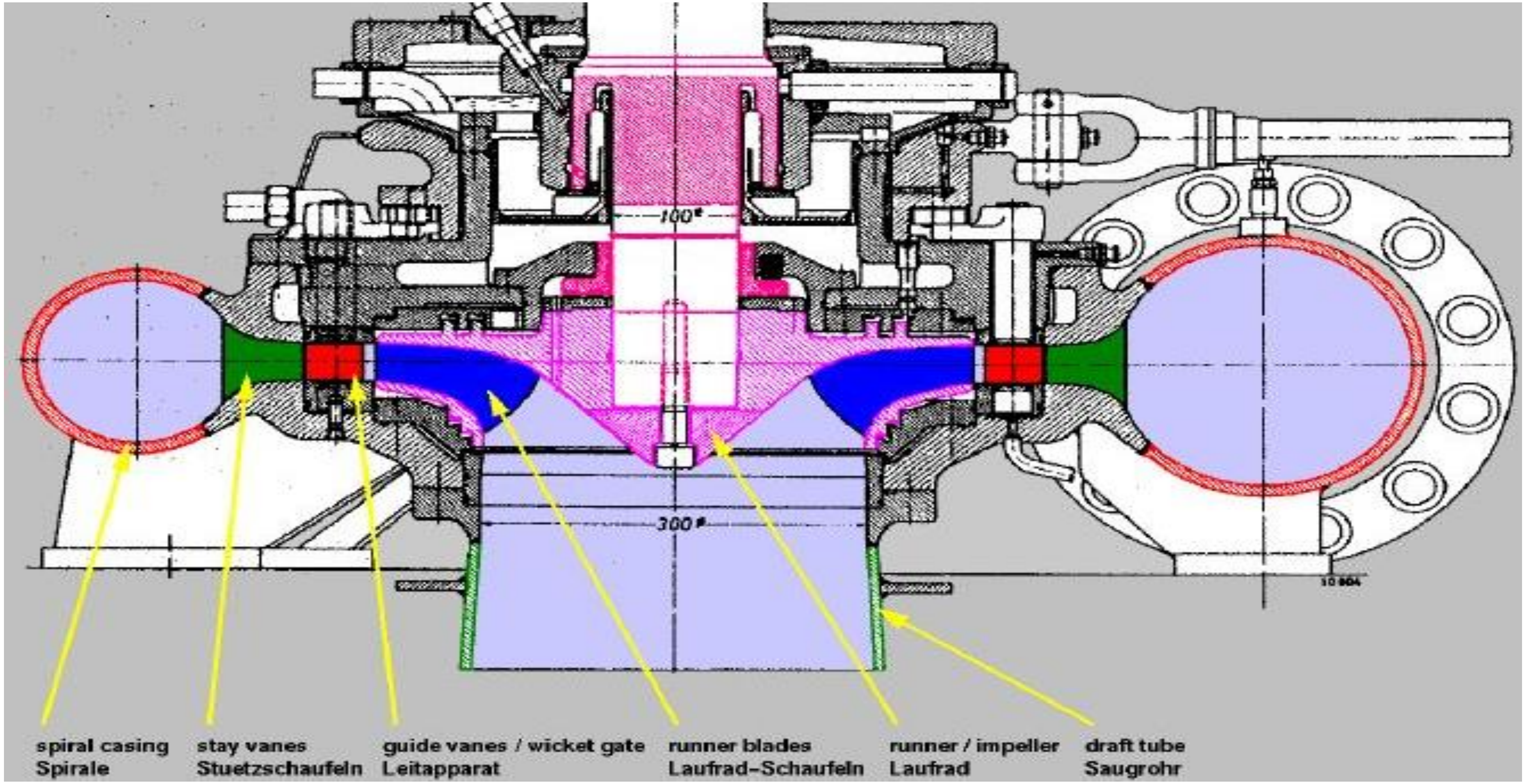


Fig. 9: Jet Impinging on Bucket

Francis Turbine

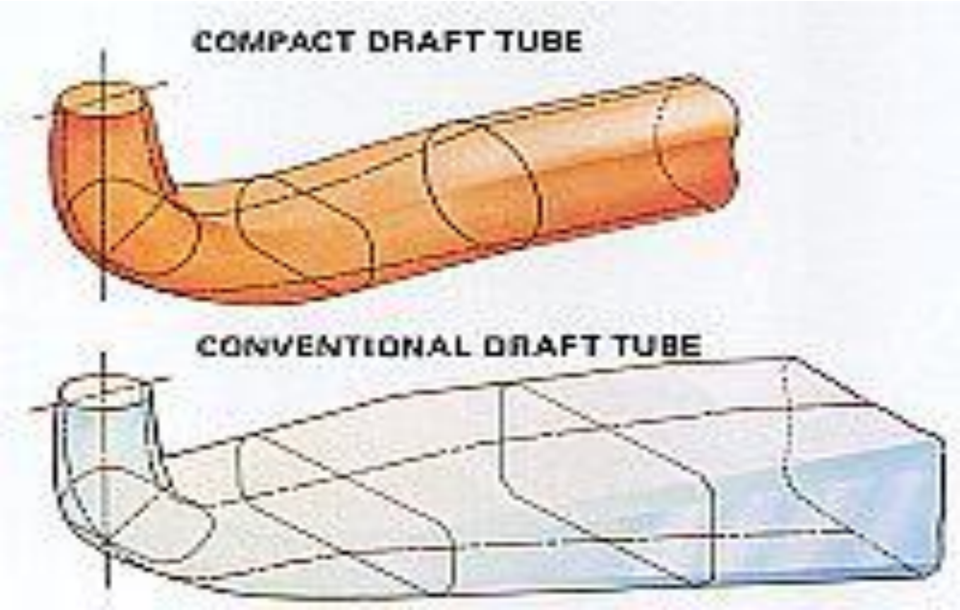


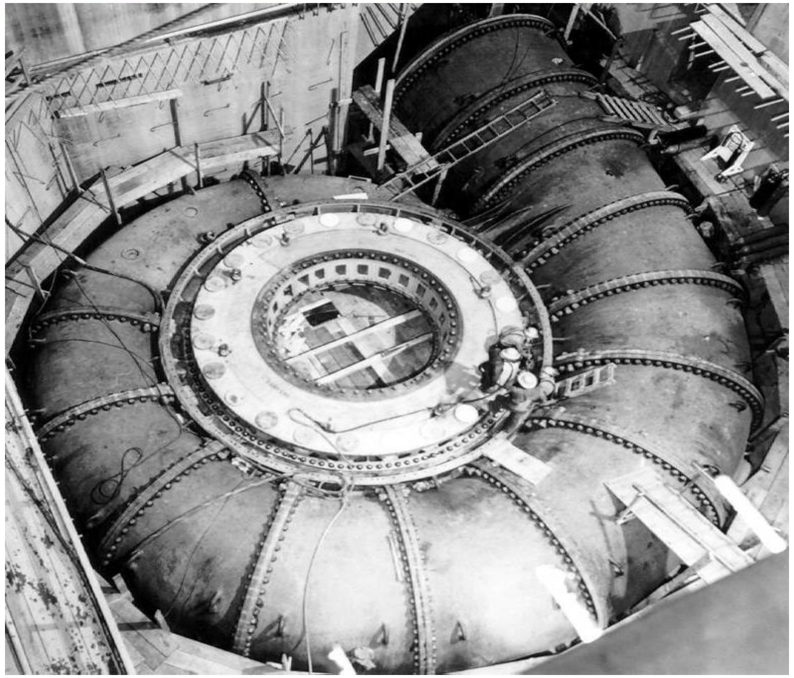
Francis Turbine

Runner for 51.4MW turbine with 41.5m head

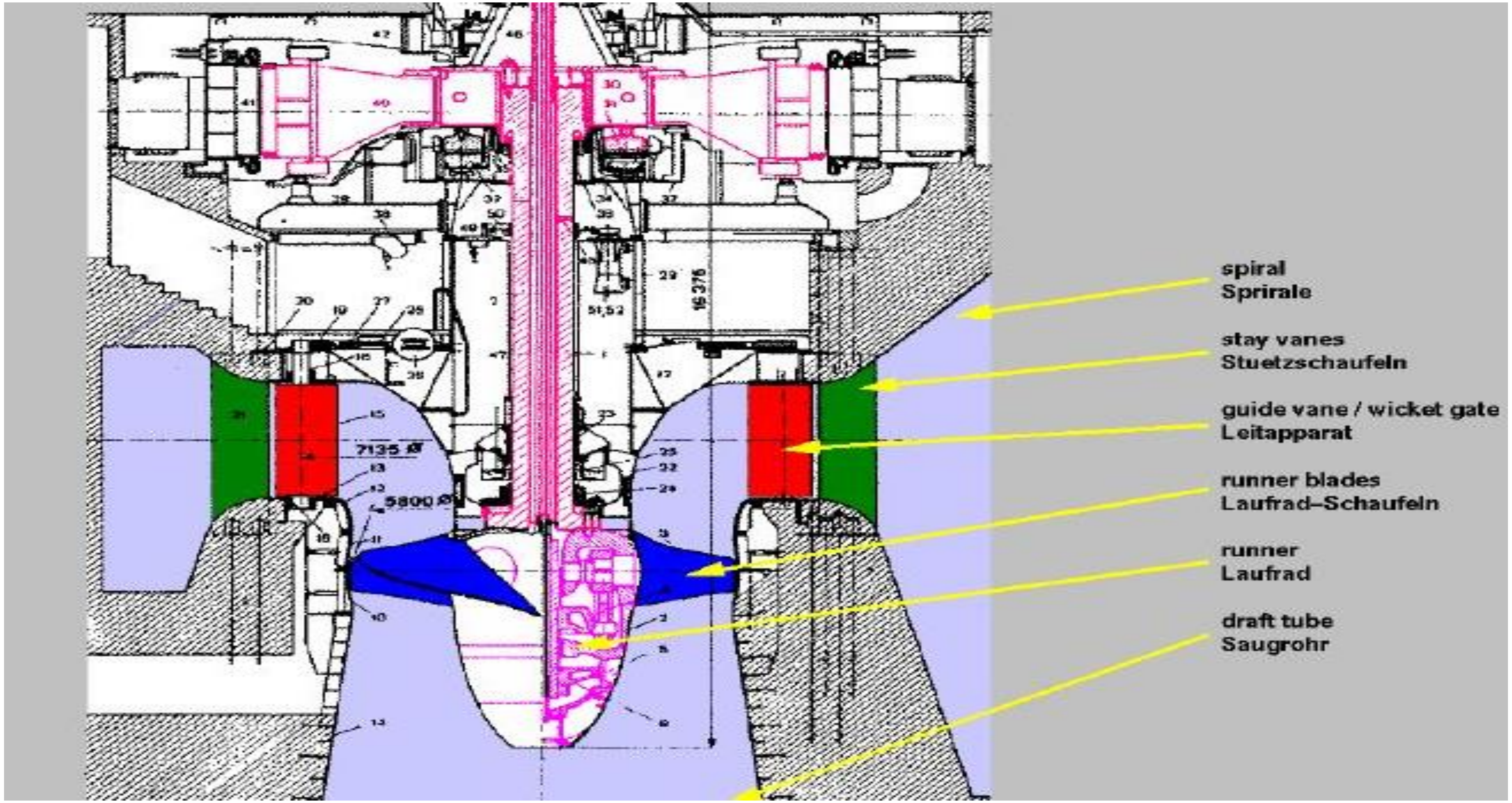
Runner for 325MW turbine with 116.2m head

Runner for 266MW turbine with 411m head



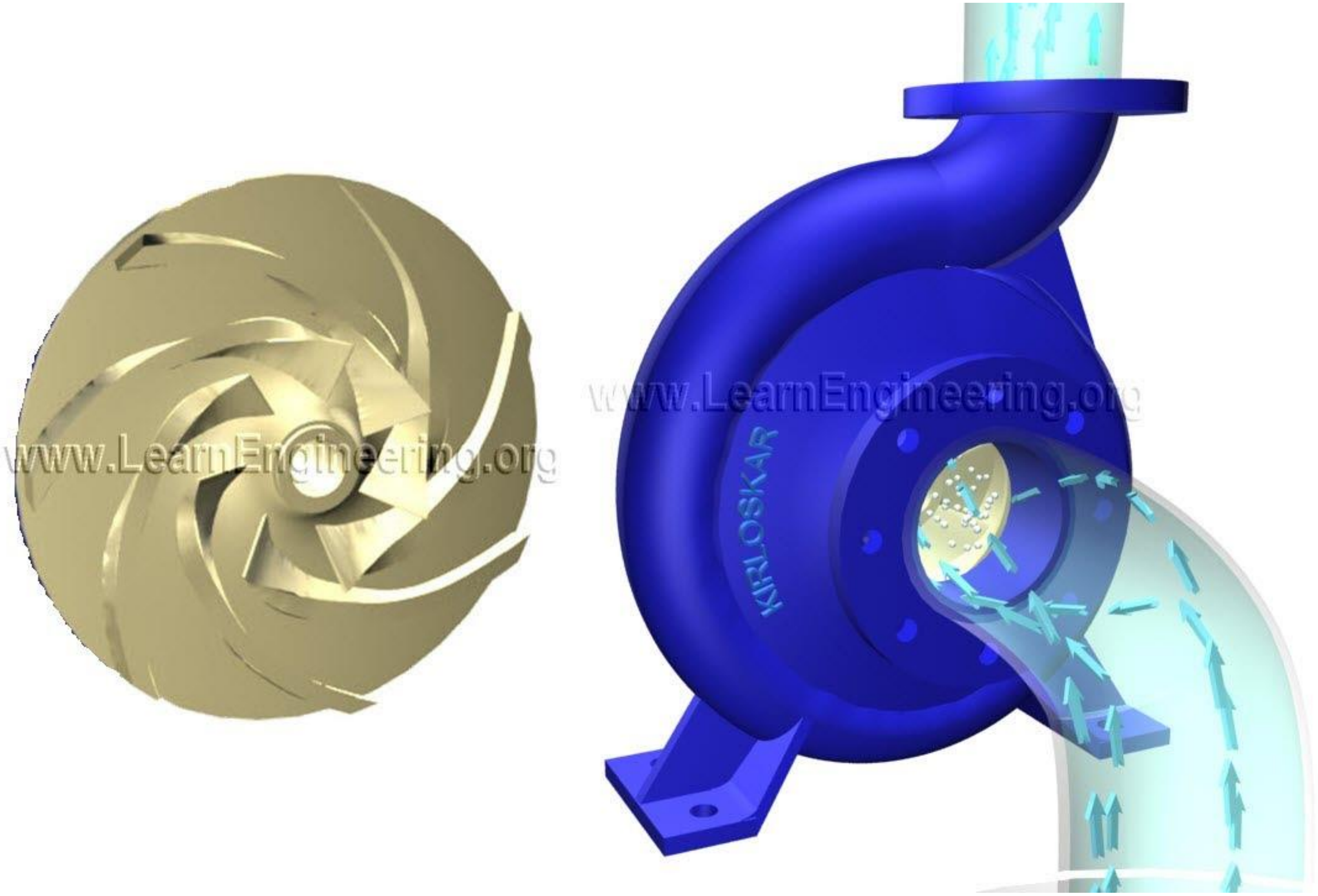


KAPLAN TURBINE



Centrifugal Pumps

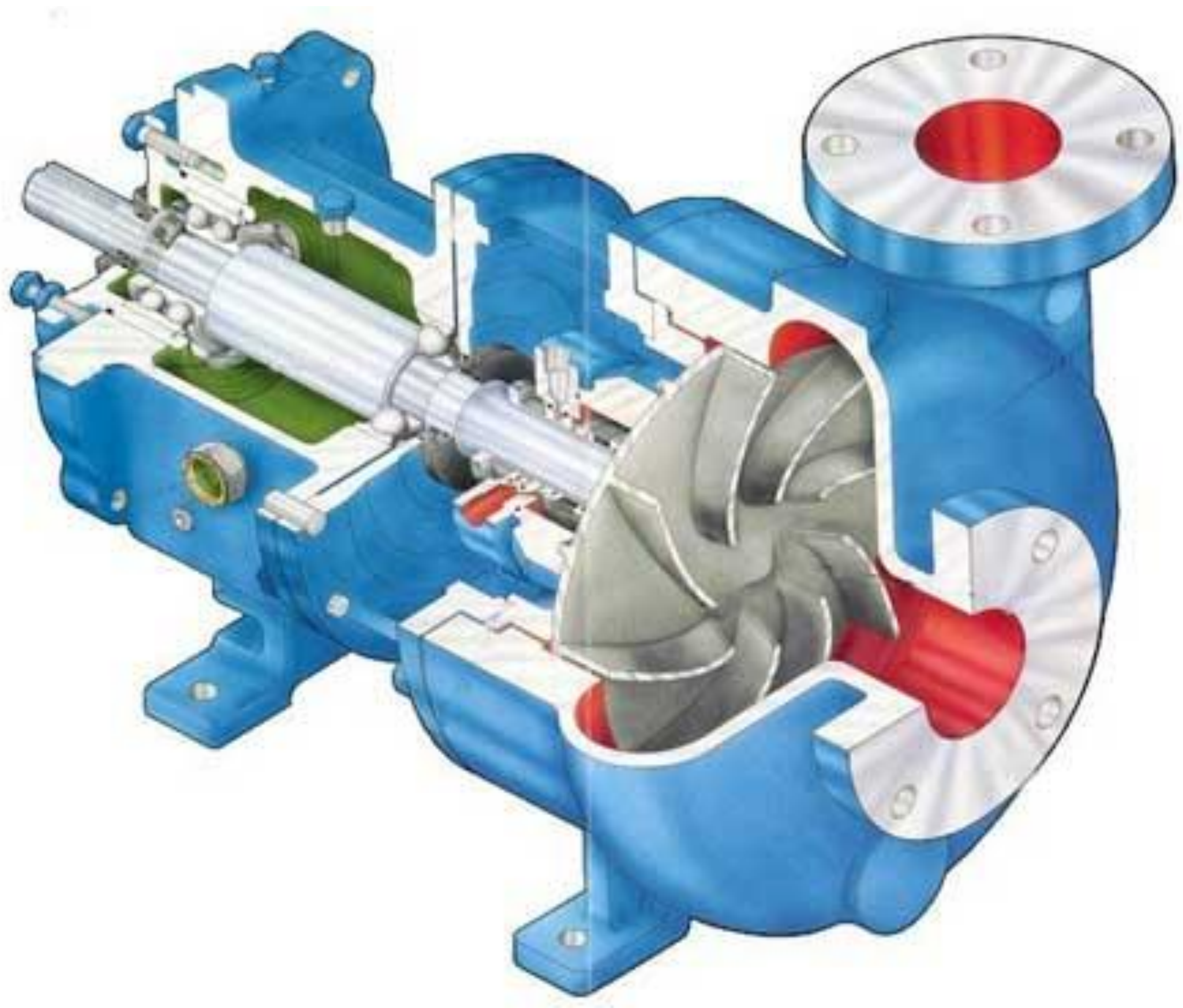
Centrifugal Pumps

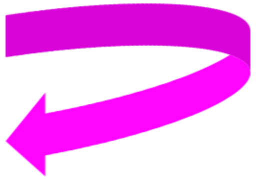


Centrifugal Pumps

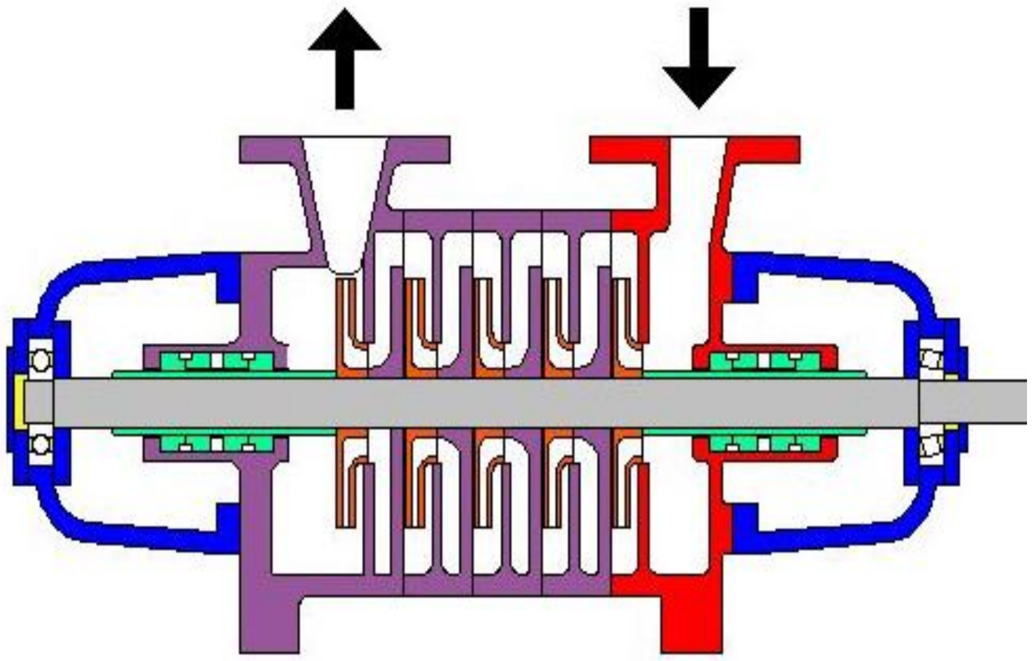
Centrifugal Pumps

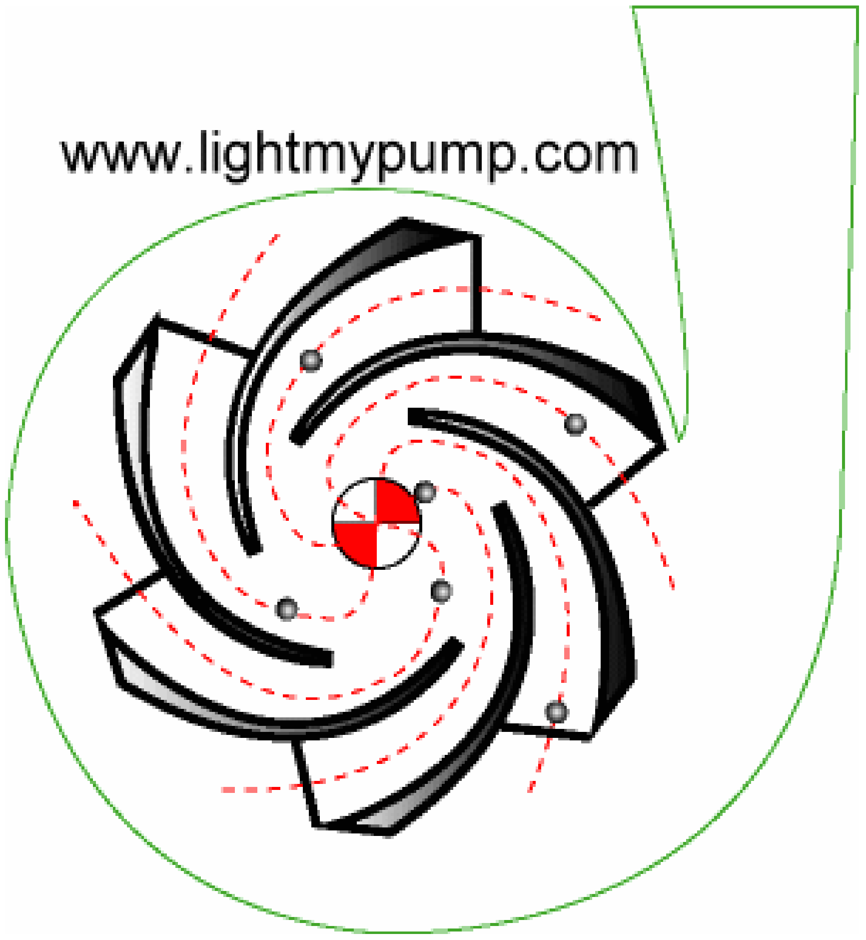
Centrifugal Pumps



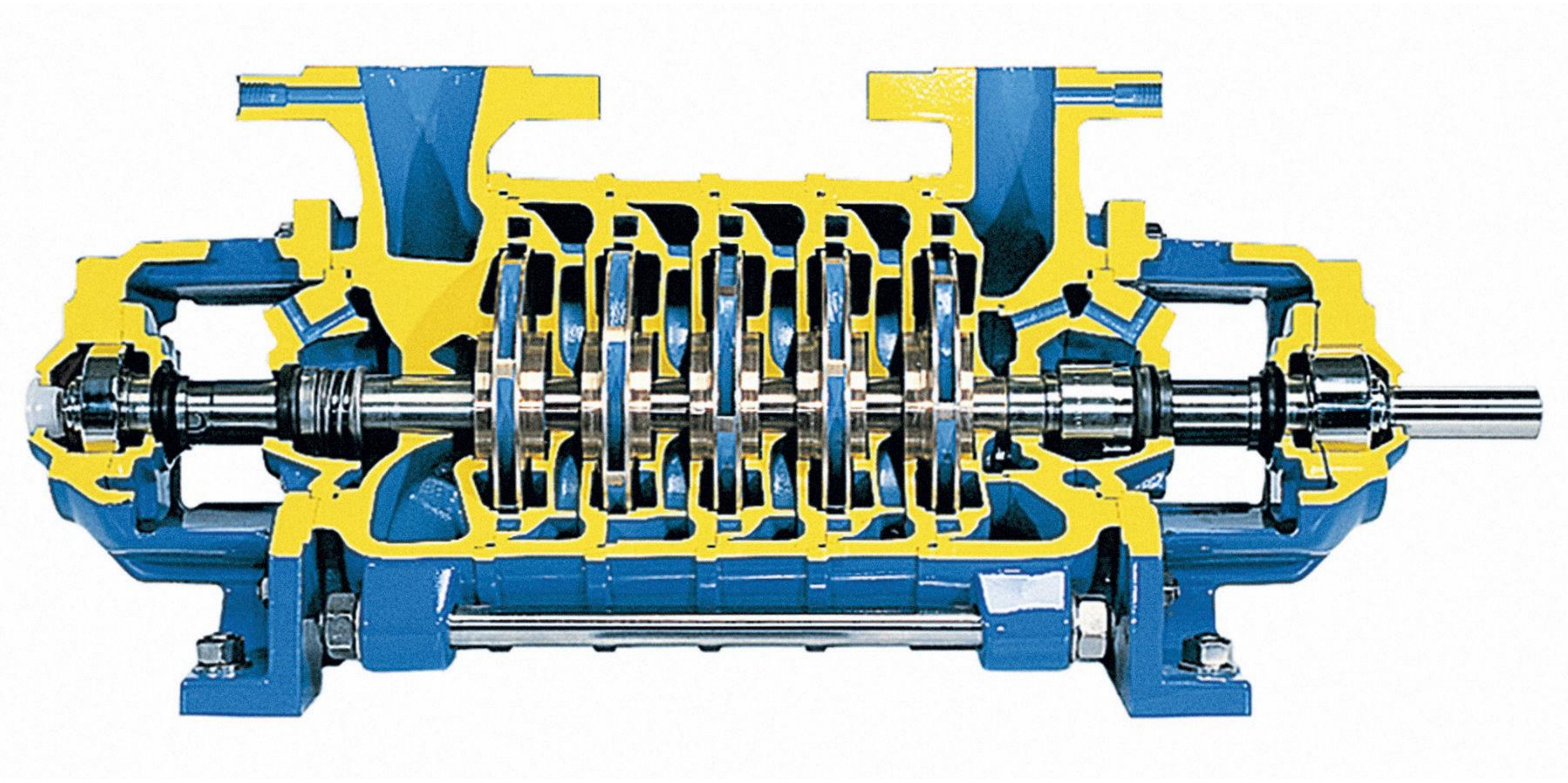


Multi stage Centrifugal Pumps

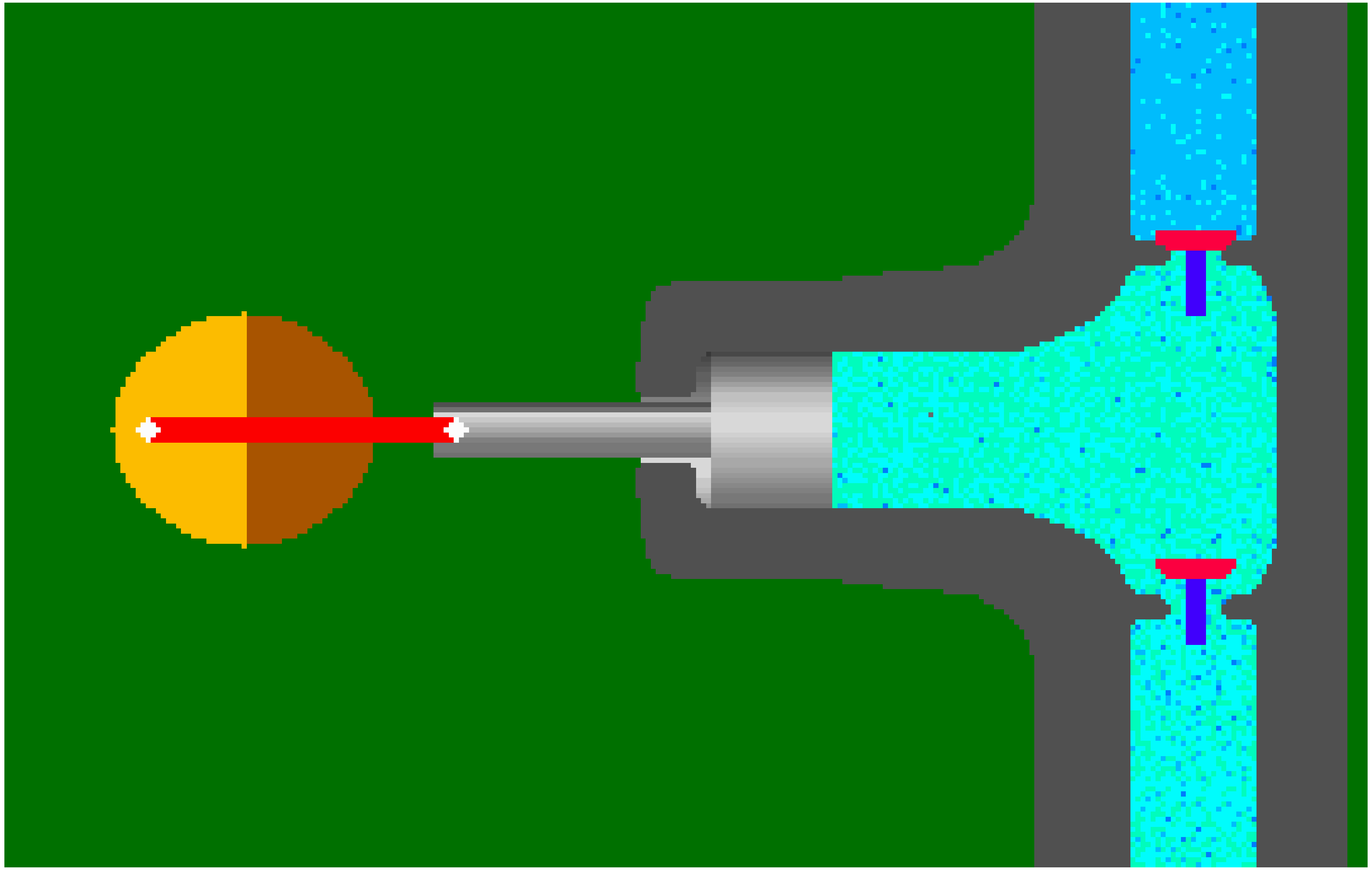




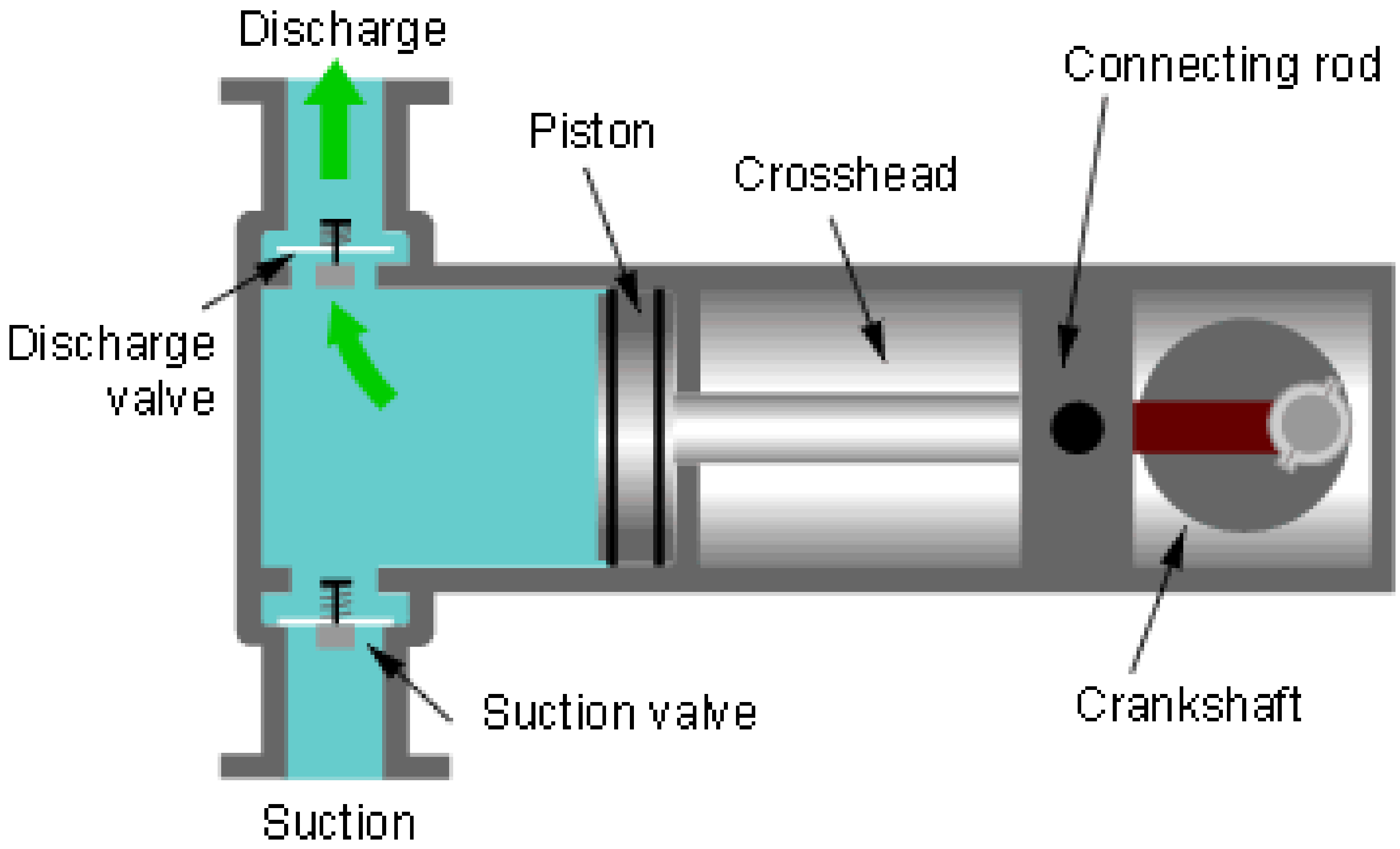
Multi stage Centrifugal Pumps



Reciprocating Pump



Centrifugal Pumps



Thank Q & ????

7. Mechanics of Solids Laboratory

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Mechanics of Solids Lab Protocol

Department of Automobile engineering

By

T. Raju - Assistant Professor
Aziz Athani - Assistant Professor
Nagaraju A Shet - Assistant Professor
M Siva Prasad - Instructor

Venue: D-002 CIVIL Engineering Department

WHY AM I TEACHING

AUTOMOBILE ENGINEERING

MECHANICAL ENGINEERING

MECHANICS OF SOLIDS

AERONAUTICAL ENGINEERING

CIVIL ENGINEERING

ARNING OVERVIEW

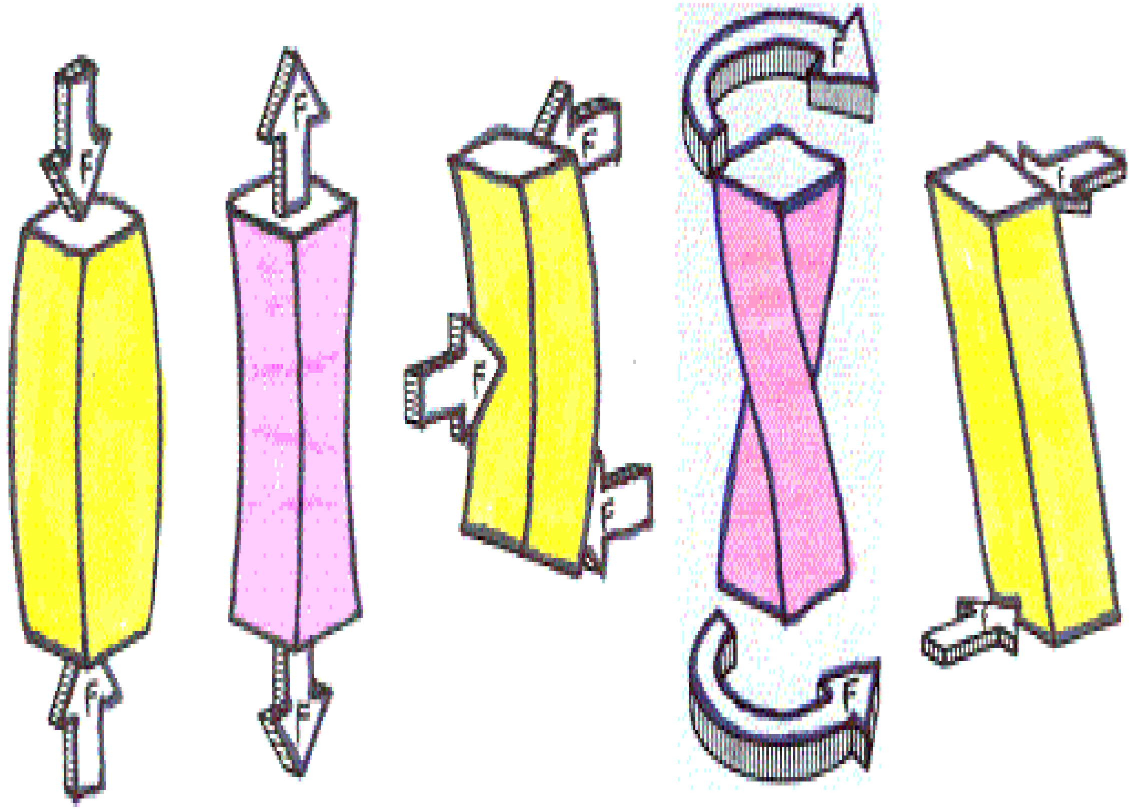
1) compression

2) Tension

3) Bending

4)Torsion and

5) Shear



RNING OVERVIEW

- It is essential for designing of various structural members and machine components subjected to various actions, so that members/components should be able to bear the maximum load without failure during the service period with knowledge of this subject.

Laboratory Introduction

- Concepts to be developed through this laboratory work:- Stress, strain, elasticity, plasticity, hardness, toughness, machinability, ductility, modulus of elasticity, modulus of rigidity, bulk modulus, strain energy, shear strength, flexural strength, torsional rigidity and stiffness.

- Principles to be understood-

  1) Hooke's law
  2) Mohr circle

Various tests for material properties

- Tension test
- Compression test
- Shear test
- Hardness test
- Torsion test
- Bending Test
- Impact test
- Mechanical advantage
- Moment of Inertia

Instrumentation

- Various instruments for measuring linear dimensions with various degrees of accuracy- scale , vernier calipers.

- Instrumentation for measuring displacements-dial gauges, electrical resistance strain gauges.

- Various methods of measuring forces-proving rings, hydraulic pressure gauges, pendulum dynamometer.

Intellectual skills

- To identify different parts of Instrument/equipment and their actions.
- To interpret failure patterns of different materials under different actions.
- To compute the required properties by measuring the appropriate displacements/deformations.
- To interpret test results or observations during the test, the properties of materials like yield stress, Ultimate strength, ductility, toughness etc. and decide the suitability of the material for a particular situation.

Intellectual Skills

- Ability to draw sketches of standard specimen, arrangement for test in respective machines.
- Ability to measure different parameters and record observations.
- Ability to handle Instruments and observe behavior of different materials during various stages of test.
- Conclusion from the results.

Objectives

- To understand the stress – strain relation of the materials in elastic and plastic stages.
- Different ways of mechanical testing will be highlighted.
- The interpretation of sensible information from the test data such that mechanical assessments are used for selecting suitable material.
- Finally , the cause of material failure will be investigated and suggest possible solutions for avoiding the failure .

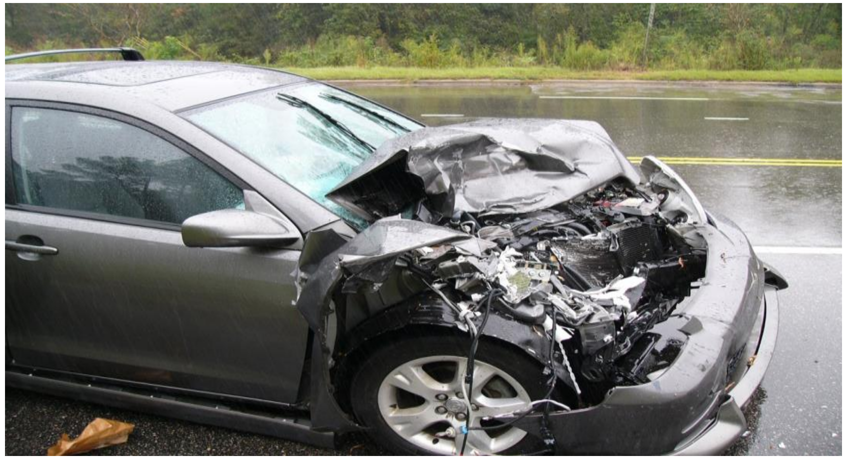
Failure in materials

- Failure of Liberty Ships during services in World War II. Seven of the Liberty ships built during the world war II have failed completely breaking into two as a result of brittle fractures. Over 1000 of approximately 5000 merchant ships built during World War II had developed cracks of considerable size and became unserviceable.

Failure in materials

The aircraft was used for inter-island transportation for 19years, failed due to multiple reasons


graceful.ali@gmail.com



Material property assessments

- Hardness --- Micro/Macro hardness tests
- Strength, Ductility --- Tension tests (elongation, area of reduction)
- Torsional rigidity --- Torsion tests
- Flexural rigidity --- Bending test
- Toughness (resistance --- Toughness tests Impact tests/ Fracture to failure)

Hardness tests

- Hardness is a property which is a measure of a resistance to permanent or plastic deformation.

- Using different indenters, i.e., ball, diamond

Parameters: 1. Brinells hardness (BHN), 2. Rockwell hardness

Rockwell →

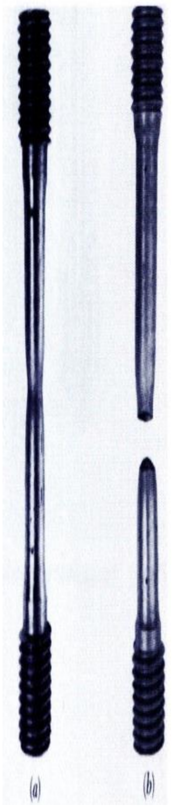
Brinell ⟶

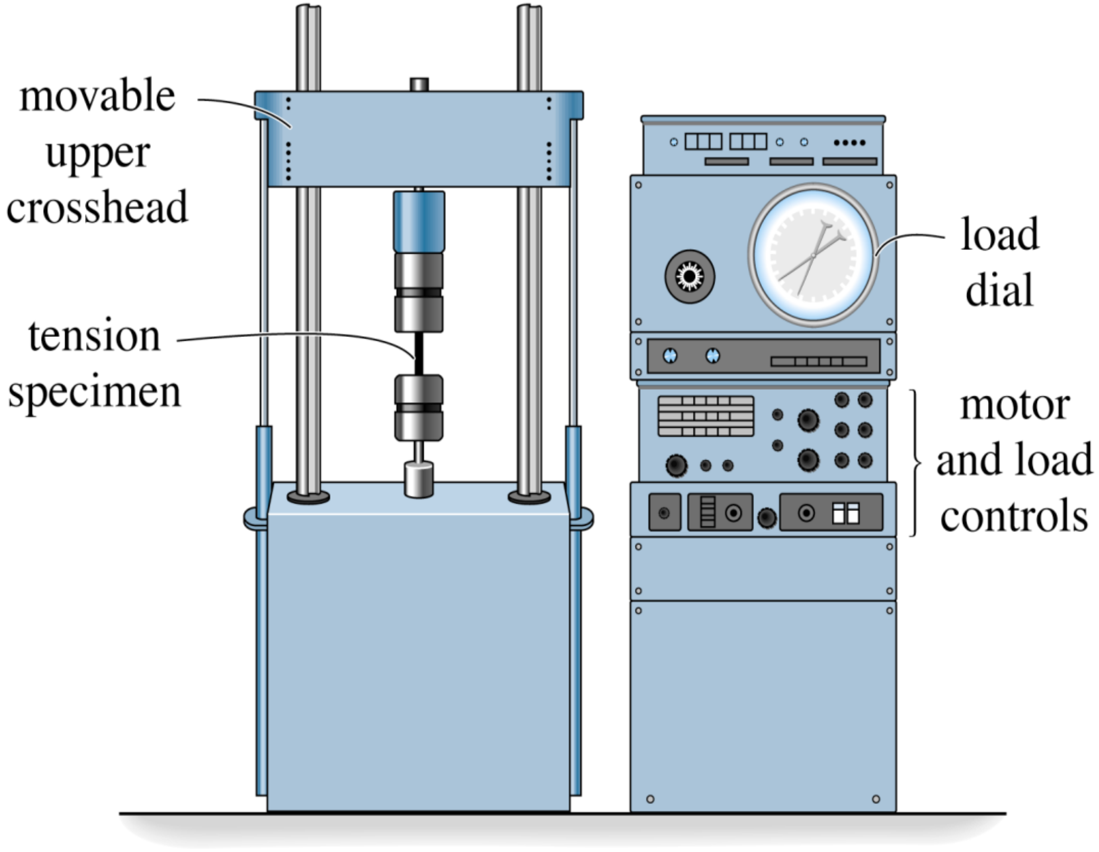
Tensile test

- Provides basic design information on the strength of materials.
- Provides acceptance test for the specification of the materials.

Parameters:

- Ultimate Tensile strength σ_U
- Yield stress σy
- Young's Modulus of elasticity E
- Ductility indices: % Elongation of
  % Area of reduction



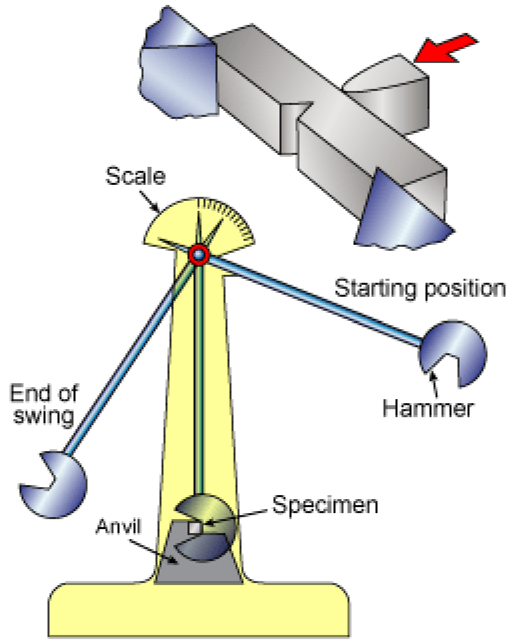


Compression Test

- Compression tests on various brittle materials are conducted on specimens in the shape of cubes or cylinders.
- Compression test on Concrete is an important test because the strength of concrete is considered only in compression.
- In every important construction project , it should be ensured that the required strength has been obtained.
- The friction between the test platen of the machine and top surface of the specimen will apply a lateral restraint on the lateral expansion of the specimen resulting due to Poisson's effect.
- True compressive strength is indicated only in a test on a cylinder with l/d ratio greater than 2
- To avoid difficulty in capping concrete cubes are tested for the determination of compressive strength of concrete.

Impact tests

- Measure toughness of materials in terms of energy absorption.
- Specimen is broken by the impact of a hammer and the energy absorbed during fracture is measured in Joules.
- Easy and works on energy principle.
- Not a standard material parameter, should be used in conjunction with other material properties such as strength and fracture toughness for materials by Izod and Charpy methods



Parameters:

- Impact energy
- Toughness

Torsion test

- Applying twisting moment to the specimen and measure the torque and angle of Twist

Parameters:

- Shear Modulus
- Polar M.I
- Torque Twist Torsional rigidity

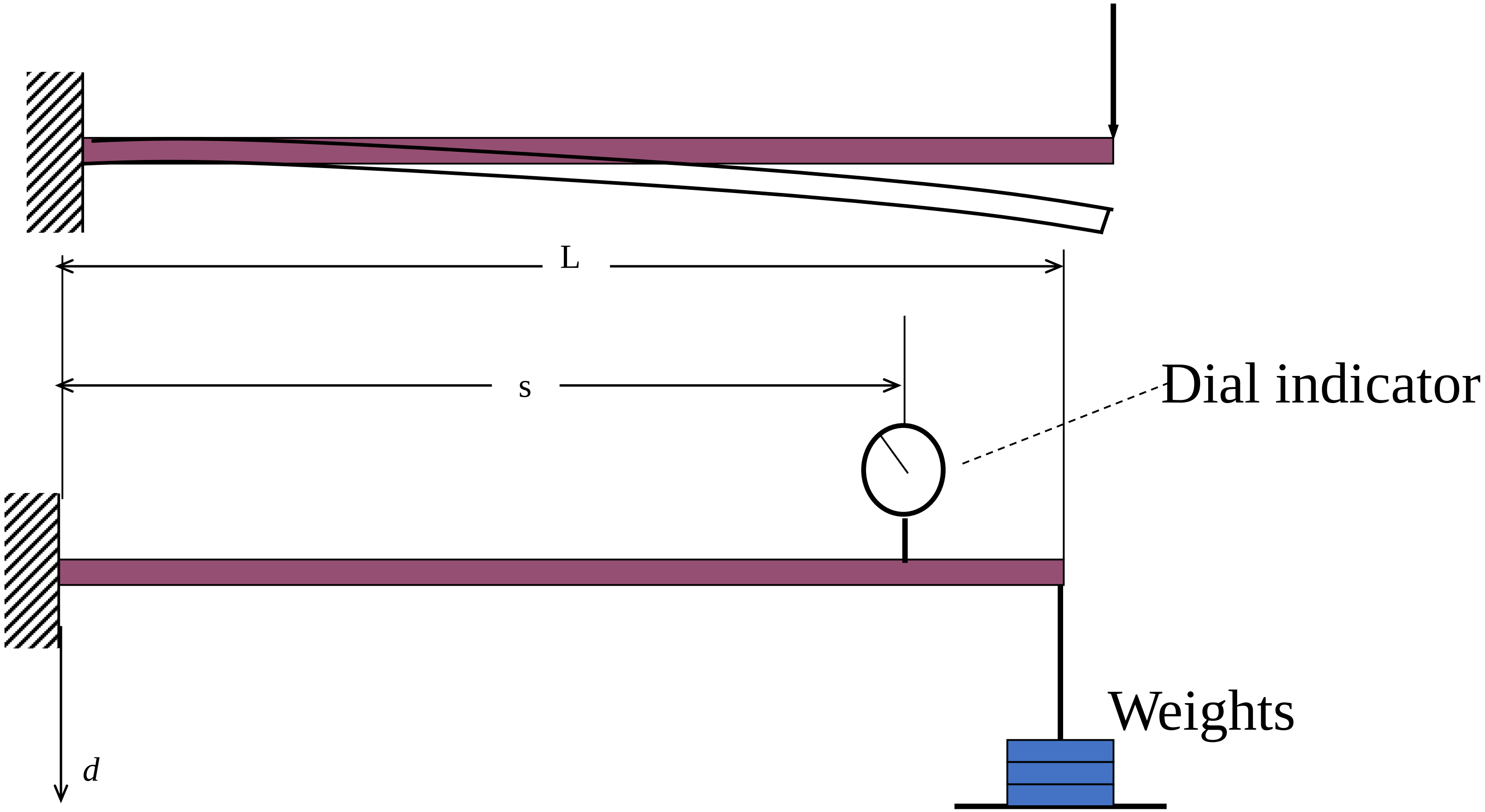
Bending of a Cantilever Beam

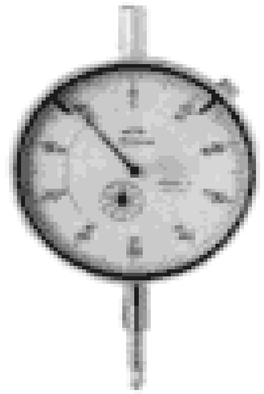
The deflection of the beam at a section depends on:

- The magnitude and position of the load
- The span of the beam.
- Material stiffness. Material of higher stiffness produces less deflection.
- The geometry of the cross section. Higher moment of inertia results in less curvature.
- Hence on Flexural rigidity .

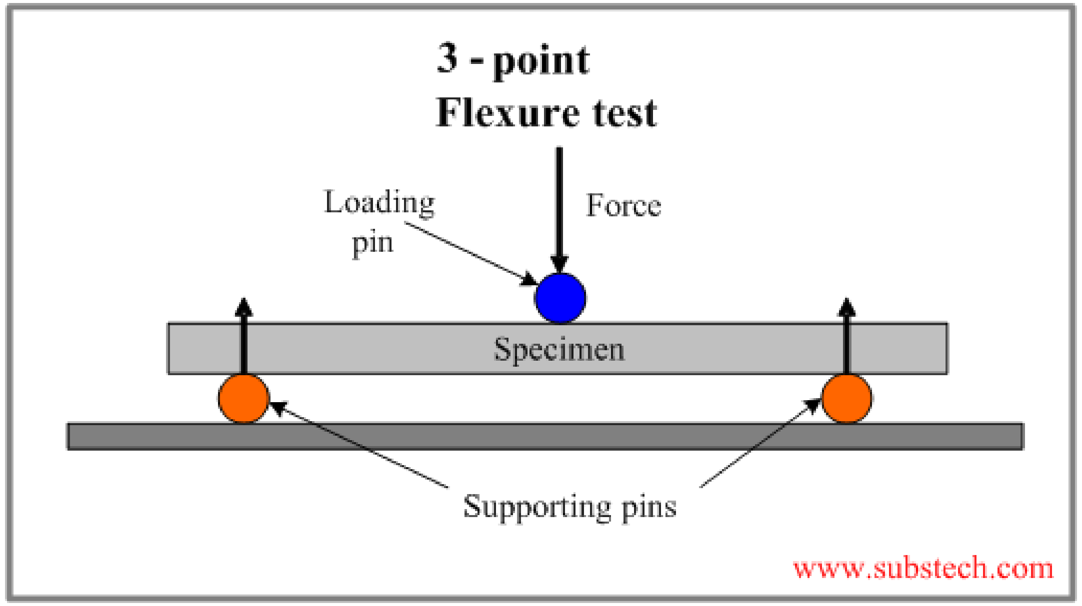
Bending of a Cantilever Beam

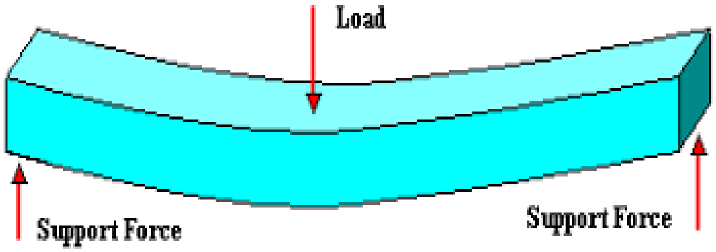
Experimental setup:



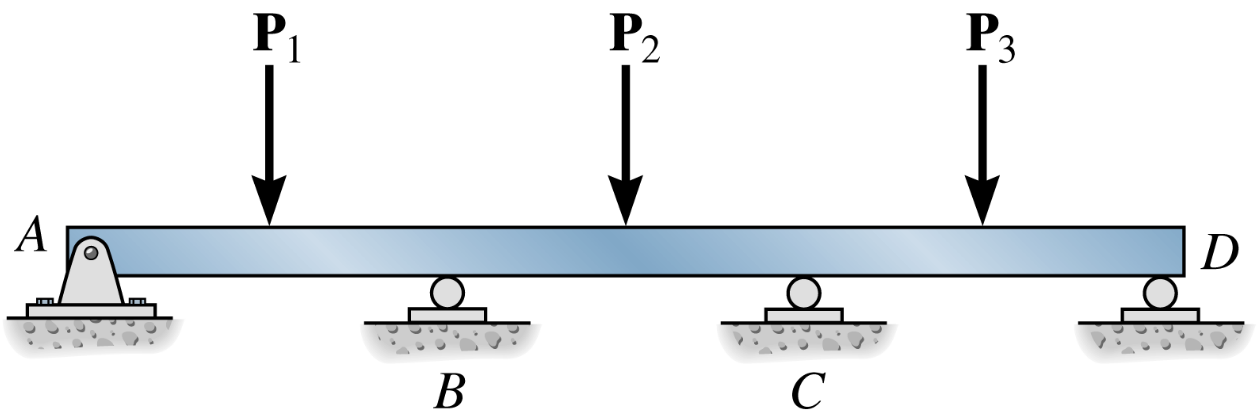


Bending of a simply supported beam





Bending test on continuous beam



(a)

Spring test

- Applying Tensile/Compressive force to the specimen and measure the Deflection sustained by the Spring.

Parameters:

- Shear Modulus
- Twisting moment
- Deflection

List of Experiments

1. To conduct the Uniaxial Tension test and to determine the yield stress, Ultimate strength, Breaking stress, % elongation & Modulus of elasticity by Tension test on Mild Steel bar.
2. To determine the crushing strength of concrete and bricks
3. To determine the Shear strength of M.S. in Double shear.
4. a)To determine the Brinell Hardness numbers for M.S., Aluminium ,copper and Brass.
5. b) To determine the Rockwell Hardness nos for M.S., Aluminum , Brass.
6. To determine the energy absorbed by the specimen of M.S., by Izod & Charpy Impact Test.
7. To determine the Modulus of rigidity of M.S. by Torsion test.
8. To determine the modulus of elasticity of the material of given beam by conducting bending test on cantilever beam.
9. To determine the modulus of elasticity of the material of given beam by conducting bending test on Simply supported beam.

List of Experiments

10. To determine Moment of Inertia of a fly wheel
11. To determine the Mechanical advantage of simple and compound screw jack
12. Demonstration of use of electrical resistance strain gauges.
13. To determine the Modulus of rigidity of a close coiled helical spring under Tension/Compression.

LAB. REPORT

- 5 persons per group
- Analyze results together
- Each person of the group will write his/her own Discussion and Conclusion.

RATORY SAFETY RULES

- Keep yourself and others safe.
- Wear appropriate safety equipment.
- No loose clothes and long hair around machines.
- Clean up any spills immediately.
- Wear shoes to protect the feet from falling weights.
- Don’t play with machines/tools.

8. Manufacturing Technology Laboratory

VNR Protocols for Laboratories
Department of Automobile Engineering
Production/Manufacturing Technology Lab

VNR Protocols for Laboratories
Department of Automobile Engineering
Manufatruring Technology Lab

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERINGT AND TECHNOLOGY

R19
III Year B. Tech. AE I Semester

(19PC2ME05) Manufacturing Technology Laboratory

Course Prerequisites: Manufacturing Technology

Course Objectives

- **Understand** casting techniques and sand properties
- **Understand** different welding processes and their uses
- **Understand** different press working operations
- To practice various machining operations

Course Outcomes

- **Apply** the knowledge involved in casting techniques
- **Decide** the selection of various welding techniques applicable for different materials
- **Integrate** the knowledge involved in press working operations
- Perform various machining operations

Experiments

- **Metal Casting**
- **Welding**
- **Mechanical Press Working**
- **Processing of Plastics**

Metal Casting

- Exercise 1: Pattern Design and making - for one casting drawing.

- Exercise 2: Sand properties testing - for strengths, and permeability

- Exercise 3: Moulding Melting and Casting

Welding

- Exercise1: Spot Welding
- Exercise 2: TIG Welding
- Exercise 3: MIG Welding
- Exercise 4: Brazing

Mechanical Press Working

1. Blanking and Piercing operations

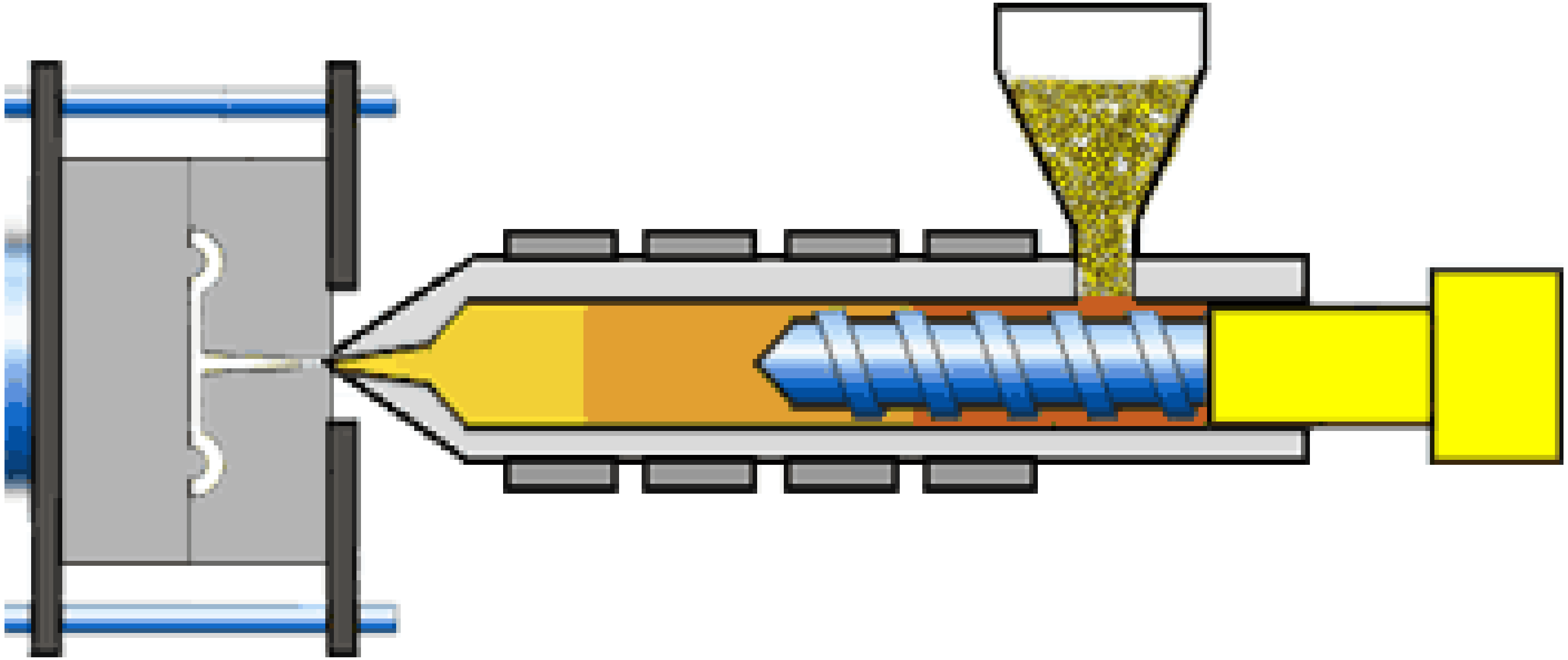
2. Bending operation

Processing of Plastics

1. Injection Moulding
2. Blow Moulding

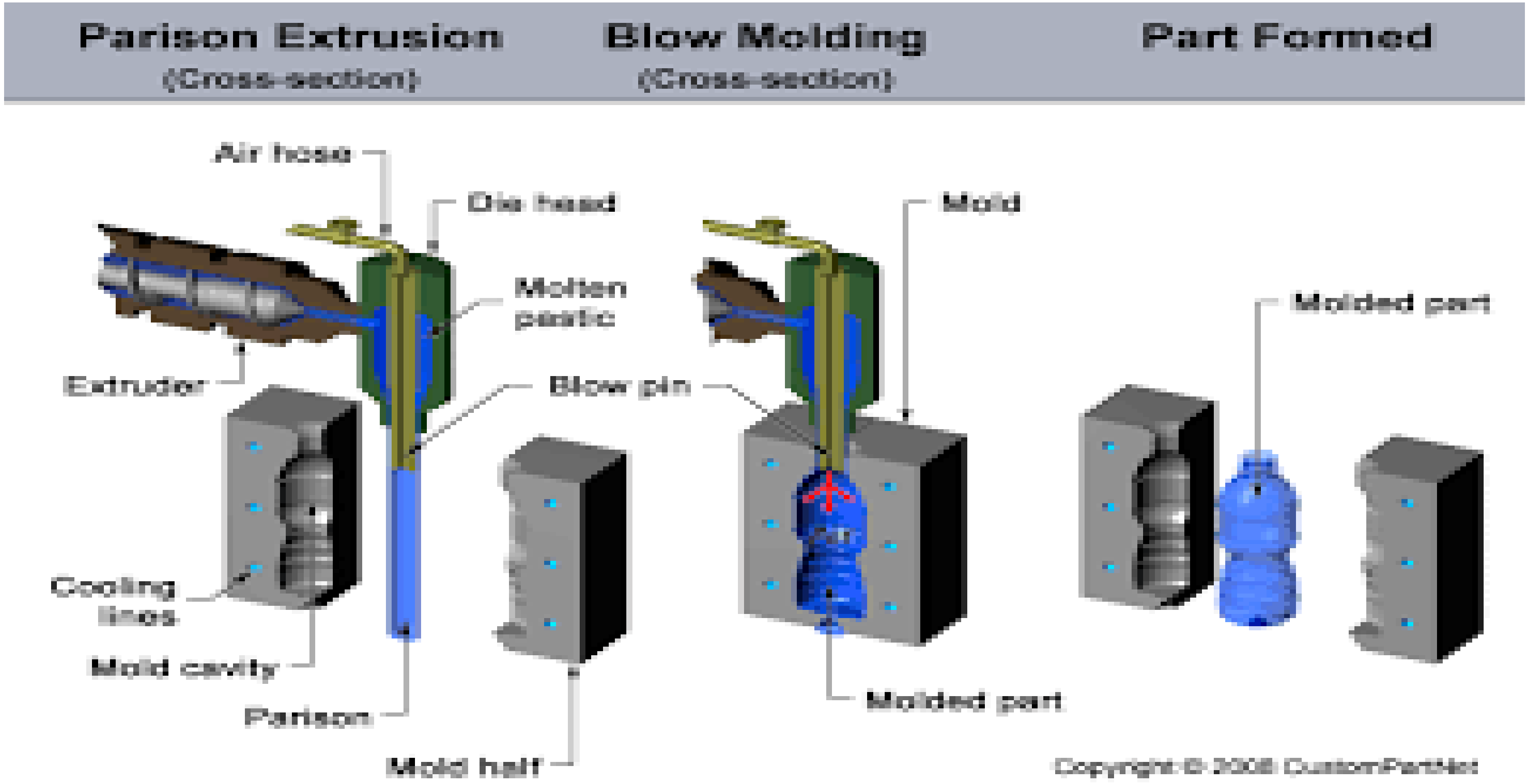
Processing of Plastics

Injection moulding:



Processing of Plastics

Blow moulding:



Experiments

- **Metal Casting**
- **Welding**
- **Mechanical Press Working**
- **Processing of Plastics**

PURPOSE OF THIS LABORATORY

To understand the various production processes which are commonly applied to Industrial Production in which raw materials are transformed to finished products on a large scale.
Such finished products may be used for manufacturing , other more complex products such as Aircraft, Automobiles, House Hold Appliances, Power Plants etc.

MANUFACTURING

The processes and methods employed to transform tangible inputs such as raw materials, semi finished goods, subassemblies, ideas, information and knowledge into goods or services

List Of Experiments

I. METAL CASTING

1. Pattern Design and Making- by Casting Drawing
2. Sand Properties Testing- for testing strength and permeability
3. Moulding , Melting & Casting

II. WELDING

1. Arc Welding: Lap & Butt Joints
2. Spot Welding
3. Tig Welding
4. Mig Welding
5. Brazing

III. MECHANICAL PRESS WORKING

1. Bending Operation

METAL CASTING

PATTERN DESIGN AND MAKING by Wood Turning lathe

METAL CASTING

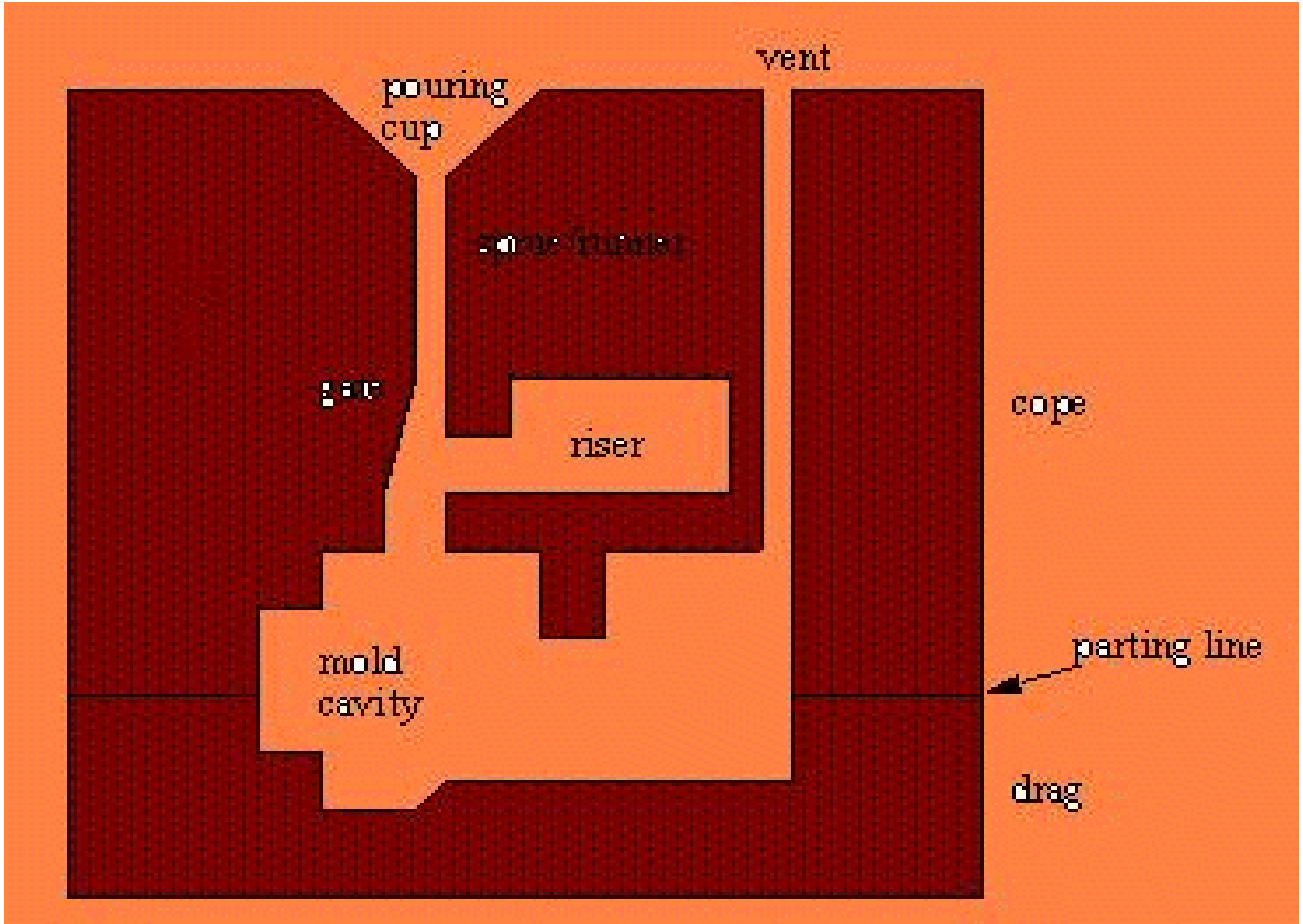
WHAT IS A PATTERN ?

- CASTING: Casting is a manufacturing process by which a liquid material is usually poured into a mold, which contains a hollow cavity of the desired shape, and then allowed to solidify. This solidified part is known as casting which is ejected or broken out of the mold to complete the process.
- PATTERN: A pattern is a replica of the desired casting which when packed in a suitable material, produces a cavity called the mold. This cavity when filled with the molten metal, produces the desired casting after solidification.
- Commonly used patterns are

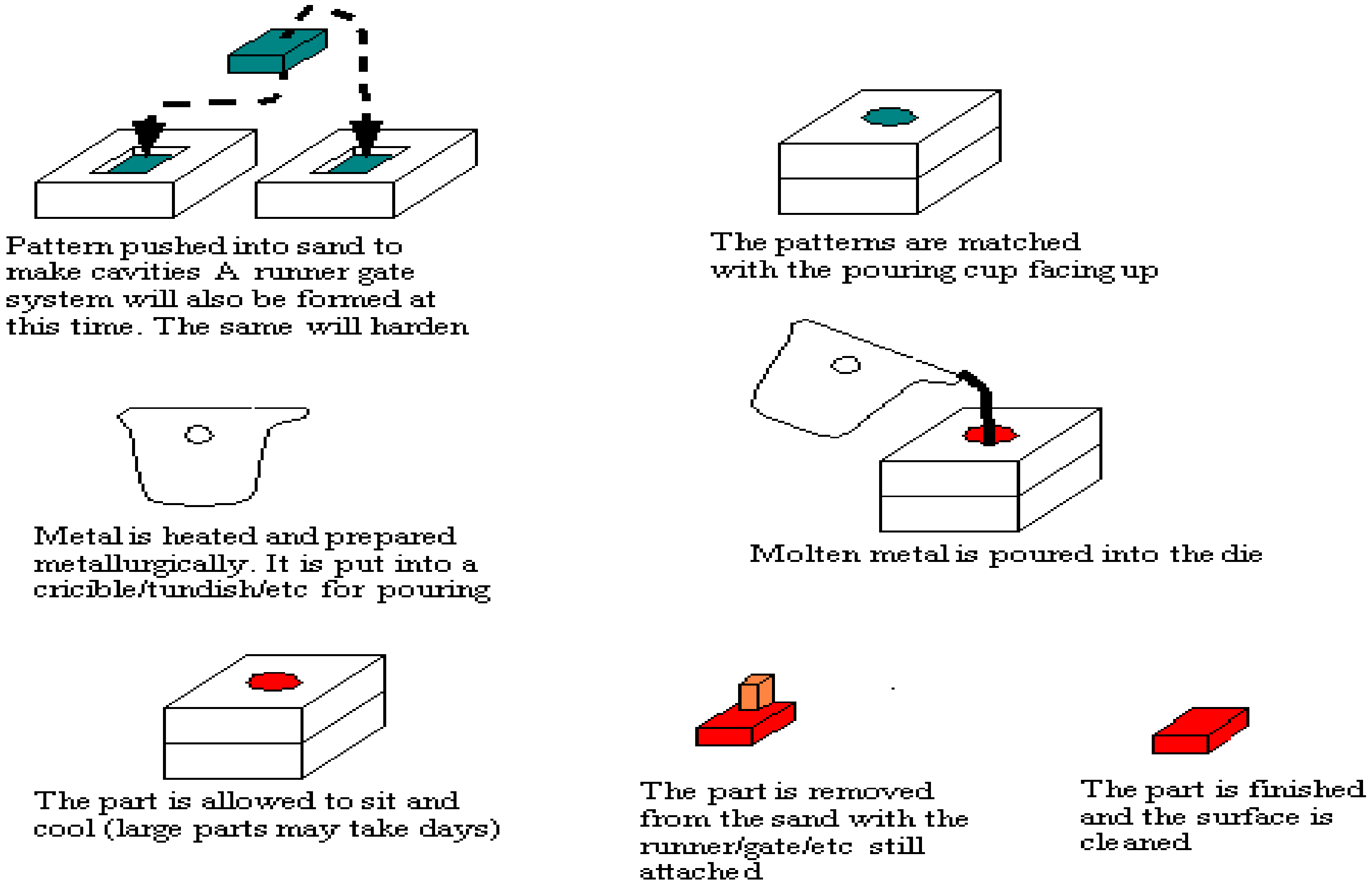
1. Single Piece Pattern
2. Split Pattern
3. Pattern with core
4. Loose Piece Pattern

Pattern materials are wood, metals & alloys, plastics, waxes.

HOW THE CASTING OF A COMPONENT IS DONE



HOW THE MOLTEN METAL FLOWS



APPLICATIONS OF METAL CASTINGS

- **Transport :** Automobile, aerospace, railways and shipping
- **Heavy Equipment :** Construction, farming and mining
- **Machine Tools :** Machining, casting, plastics molding, forging, extrusion and forming
- **Plant Machinery :** Chemical, petroleum, paper, sugar, textile, steel and thermal plants
- **Defence :** Vehicles, artillery, munitions, storage and supporting equipment
- **Electrical Equipment Machines :** Motors, generators, pumps and compressors
- **Hardware :** Plumbing industry pipes, joints, valves and fittings
- **Household :** Appliances, kitchen and gardening equipment, furniture and fittings
- **Art Objects :** Sculptures, idols, furniture, lamp stands and decorative items

SAND PROPERTIES TESTING- FOR CONDUCTING STRENGTH & PERMEABILITY
by Universal Strength Machine & Sand rammer

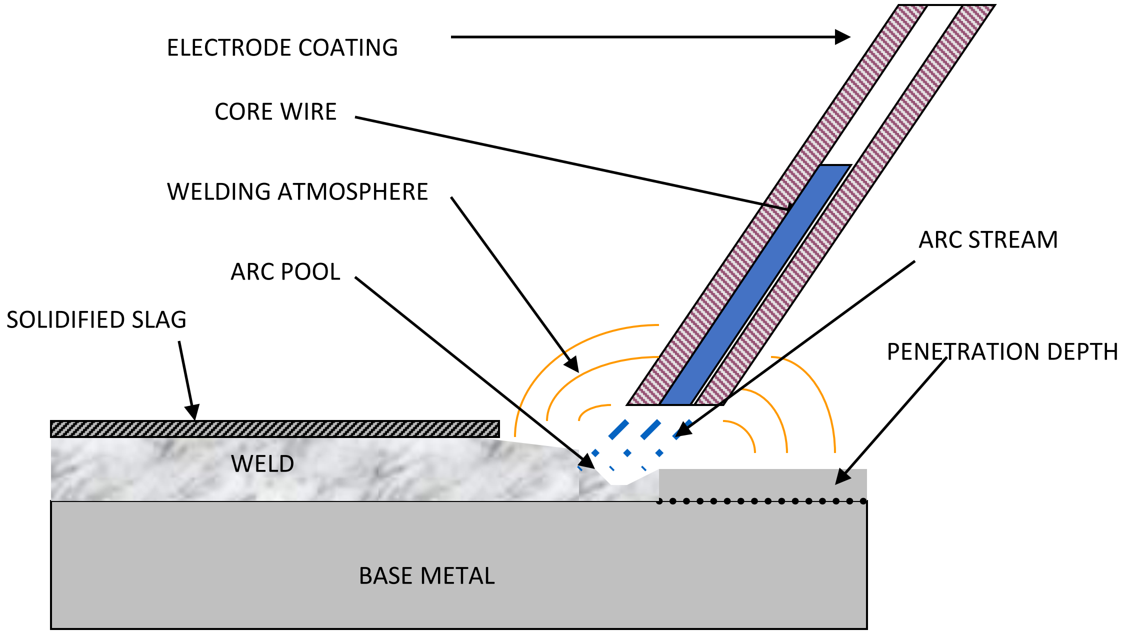
PERMEABILITY TESTING OF SAND

- **Permeability** is the property by which we can know the ability of sand to transmit gas. The permeability is commonly tested to see if it is correct for the casting conditions

Welding Processes

ARC WELDING

WORKING OF ARC WELDING



Weld Fluxes

- Typical fluxes
  - SiO_2, TiO_2, FeO, MgO, Al_2O_3
  - Produces a gaseous shield to prevent contamination
  - Act as scavengers to reduce oxides
  - Add alloying elements to the weld
  - Influence shape of weld bead during solidification

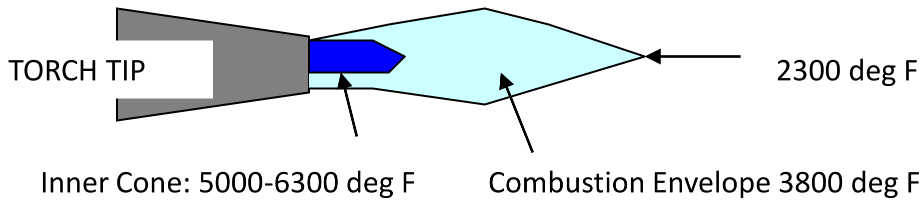
GAS WELDING

GAS WELDING

- Sound weld is obtained by selecting proper size of flame, filler material and method of moving torch
- The temperature generated during the process is 3300^0c
- When the metal is fused, oxygen from the atmosphere and the torch combines with molten metal and forms oxides, results defective weld
- Fluxes are added to the welded metal to remove oxides
- Common fluxes used are made of sodium, potassium. Lithium and borax.
- Flux can be applied as paste, powder,liquid.solid coating or gas.

Oxyacetylene Welding (gas welding)

- Flame formed by burning a mix of acetylene (C_2H_2) and oxygen

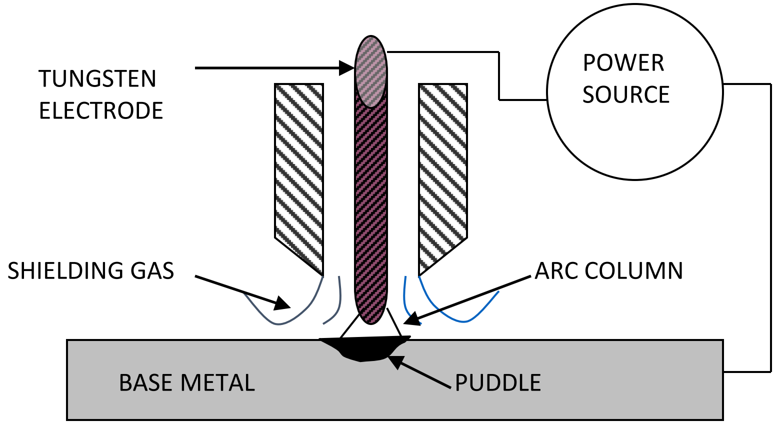


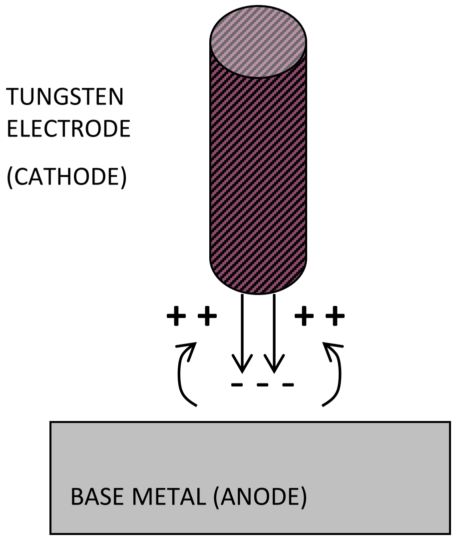
- Fusion of metal is achieved by passing the inner cone of the flame over the metal
- Oxyacetylene can also be used for cutting metals

TIG –WELDING (tungsten inert gas)

Tungsten Inert Gas (TIG)

- Tungsten electrode acts as a cathode
- A plasma is produced between the tungsten cathode and the base metal which heats the base metal to its melting point
- Filler metal can be added to the weld pool





Techniques for Basic Weld Joints

Manual Torch Movement

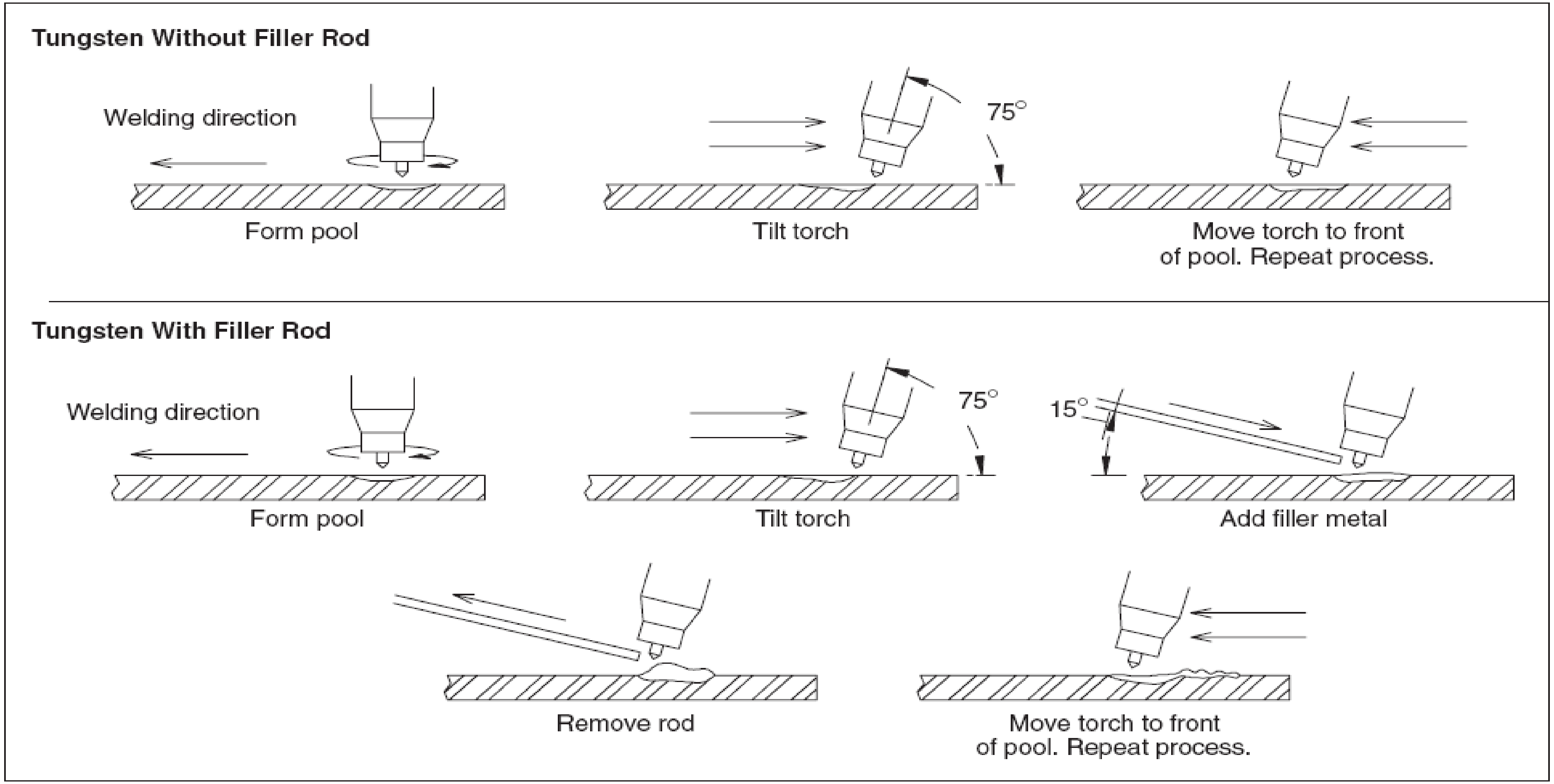
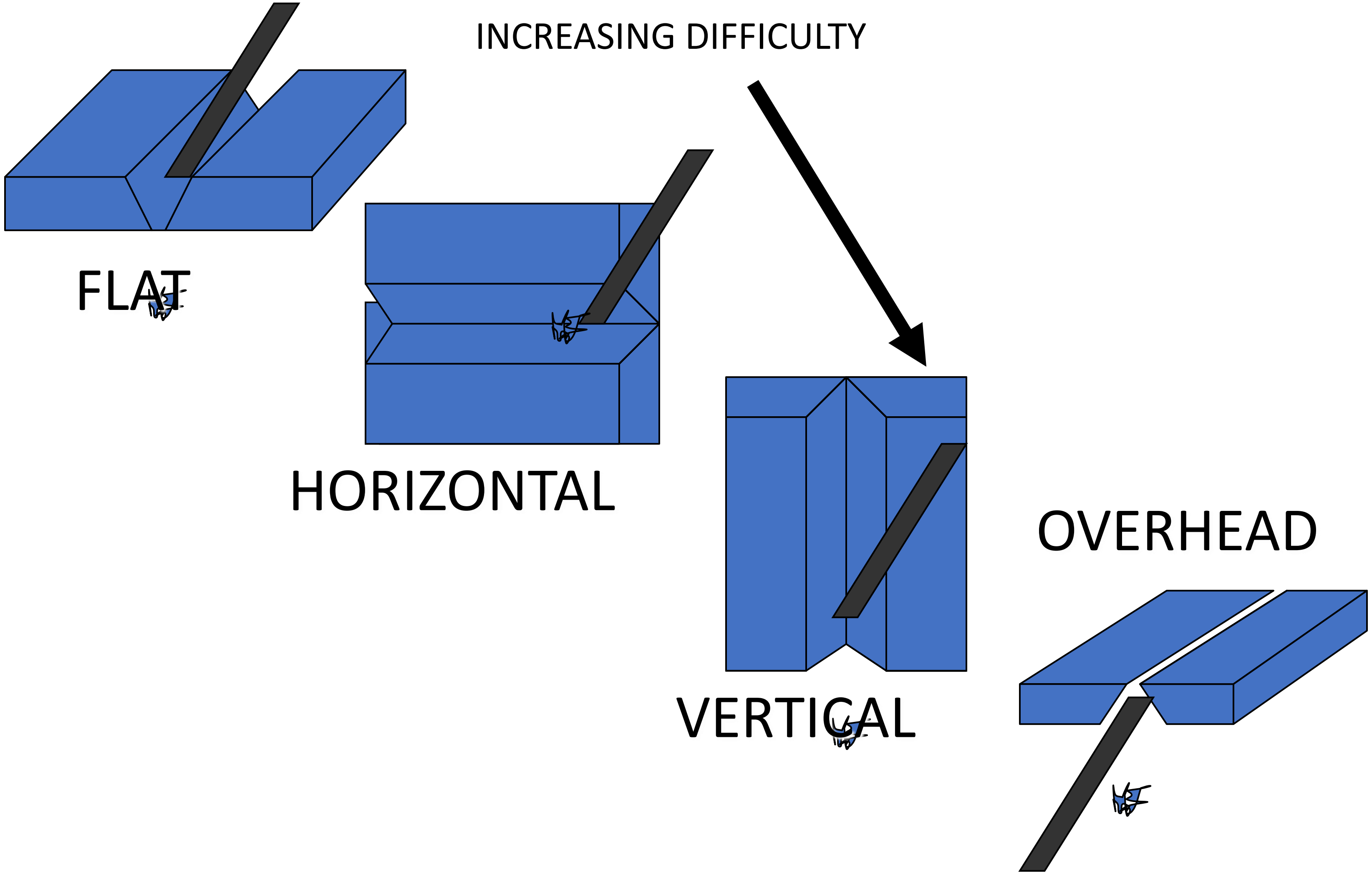


*Figure copied from “TIG Handbook”

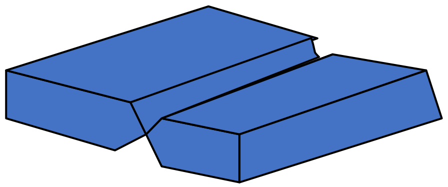
Inert Gases

- Argon, Helium, Nitrogen, and Carbon dioxide
- Form a protective envelope around the weld area
- Used in
    - MIG
    - TIG
    - Shield Metal Arc

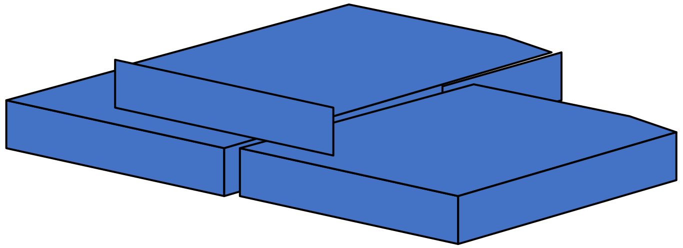
Welding Positions



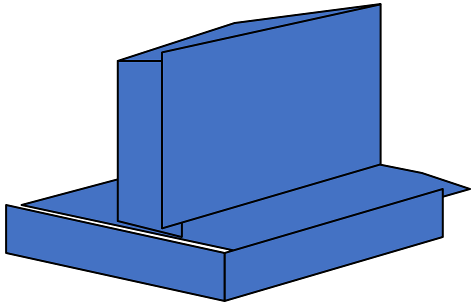
Joint Design



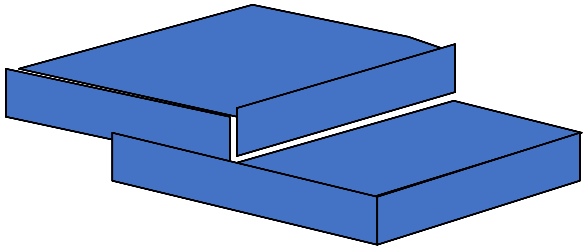
BUTT JOINT



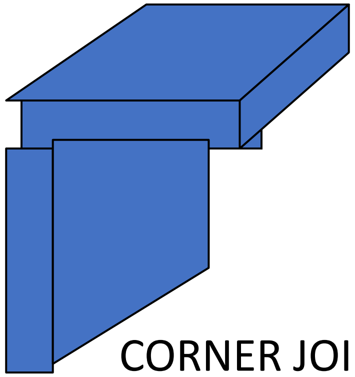
STRAP JOINT



FILLET JOINT



LAP JOINT



CORNER JOINT

Brazing

- **Brazing**

  Brazing is a metal-joining process whereby a filler metal is heated above melting point and distributed between two or more close-fitting parts by capillary action. The filler metal is brought slightly above its melting (liquidus) temperature while protected by a suitable atmosphere, usually a flux. It then flows over the base metal (known as wetting) and is then cooled to join the workpieces together

SPOT WELDING

SPOT WELDING

- Spot welding (RSW) is a process in which contacting metal surfaces are joined by the heat obtained from resistance to electric current flow.
- Work-pieces are held together under pressure exerted by electrodes. Typically the sheets are in the 0.5 to 3 mm (0.020 to 0.12 in) thickness range. The process uses two shaped copper alloy electrodes to concentrate welding current into a small "spot" and to simultaneously clamp the sheets together.
- Forcing a large current through the spot will melt the metal and form the weld. The attractive feature of spot welding is a lot of energy can be delivered to the spot in a very short time (approximately ten milliseconds). That permits the welding to occur without excessive heating to the rest of the sheet

Fly Press

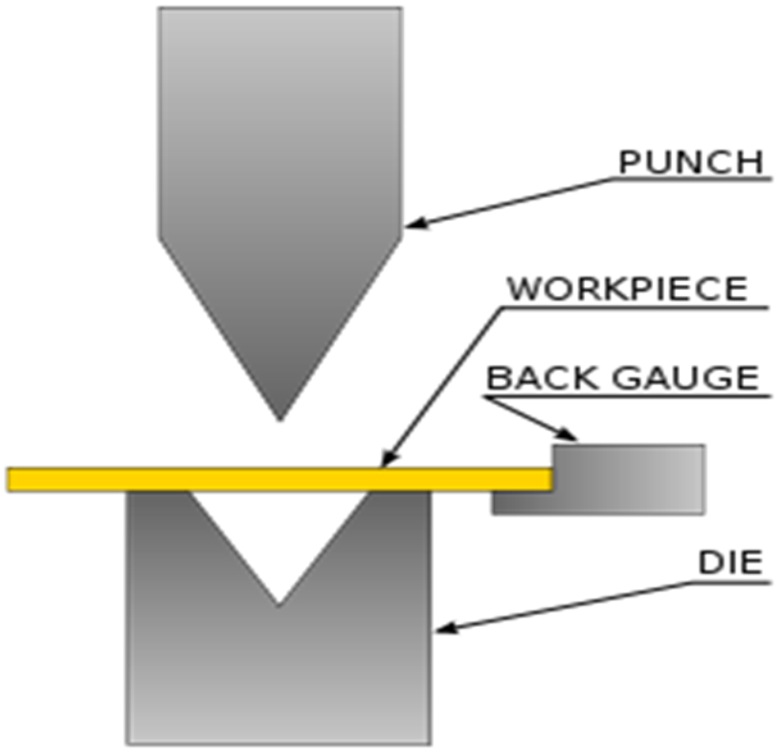
Fly Press

BENDING OPERATION

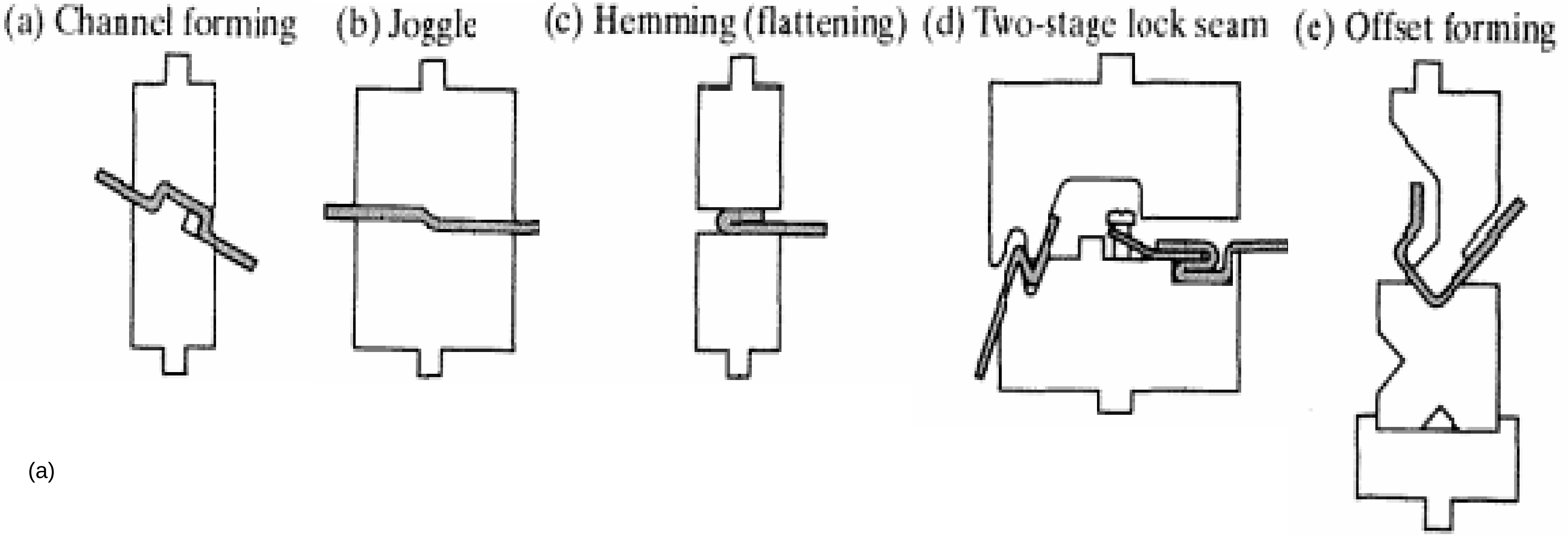
Hydraulic Press

BENDING OPERATION

- **Bending** is a manufacturing process that produces a V-shape, U-shape, or channel shape along a straight axis in ductile materials, most commonly sheet metal. Commonly used equipment include box and pan brakes, brake presses, and other specialized machine presses. Typical products that are made like this are boxes such as electrical enclosures and rectangular ductwork.



Typical bending operations and shapes

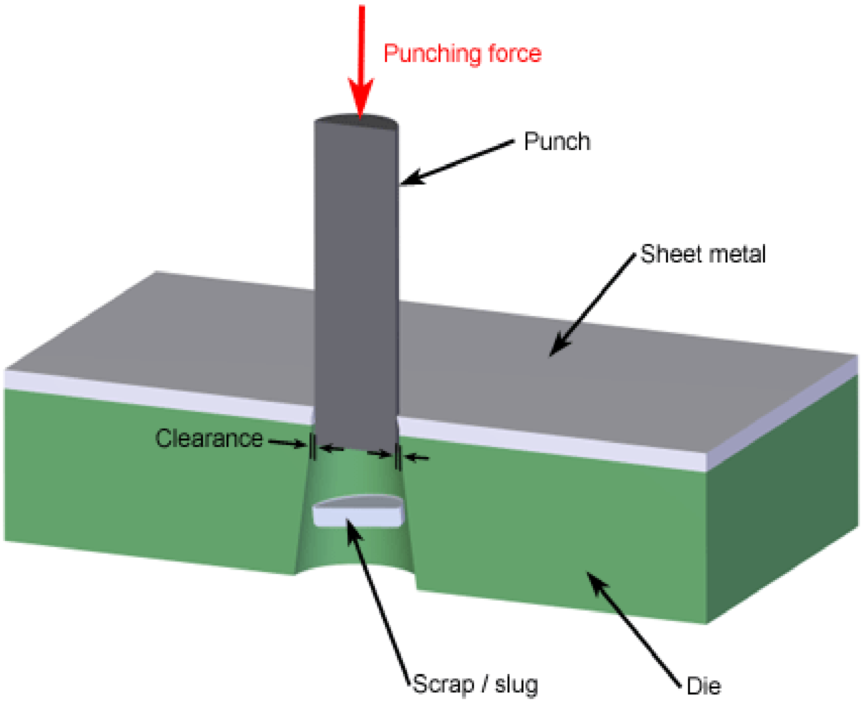


(a)

(b)

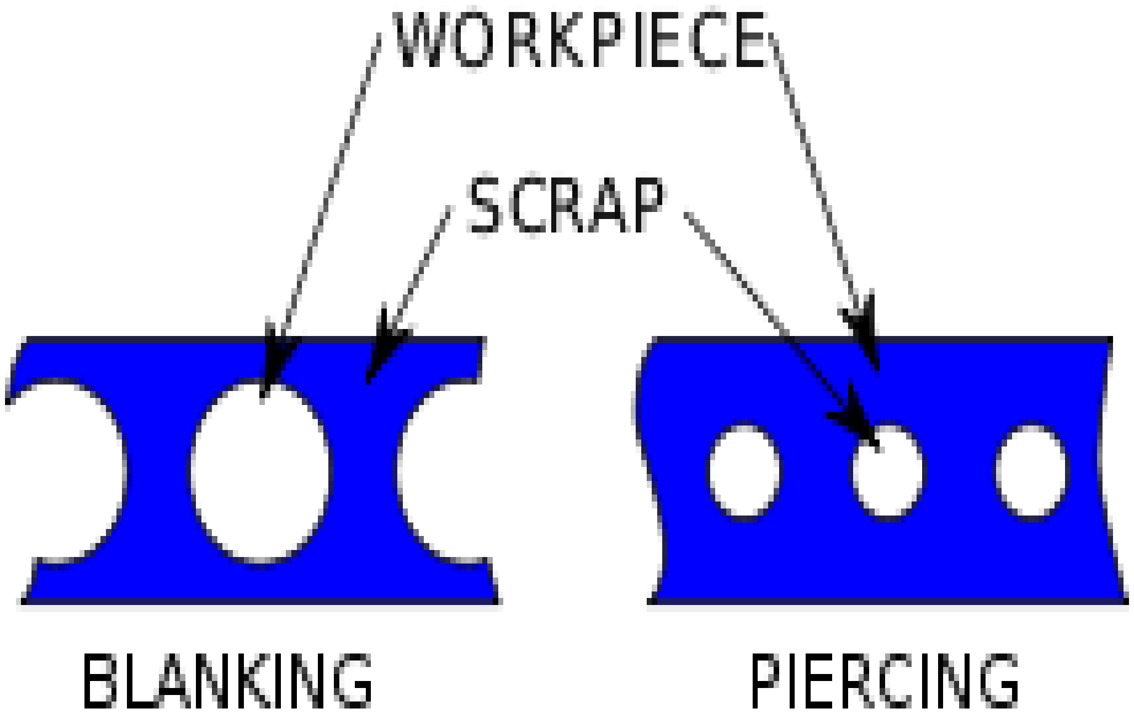
PUNCHING OPERATION

- Punching is a metal forming process that uses a punch press to force a tool, called a punch, through the workpiece to create a hole via shearing.
- The punch often passes through the work into a die. A scrap slug from the hole is deposited into the die in the process.



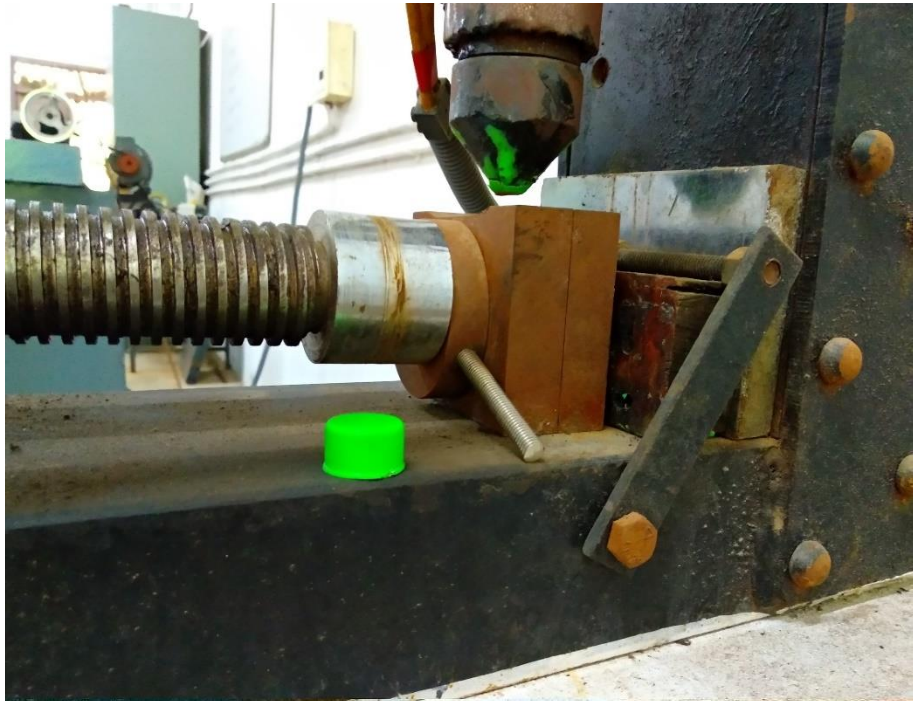
BLANKING AND PIERCING

Blanking and piercing are shearing processes in which a punch and die are used to modify webs. The tooling and processes are the same between the two, only the terminology is different: in blanking the punched out piece is used and called a blank; in piercing the punched out piece is scrap.



PLASTICS PROCESSING-INJECTION MOULDING

Injection Moulding



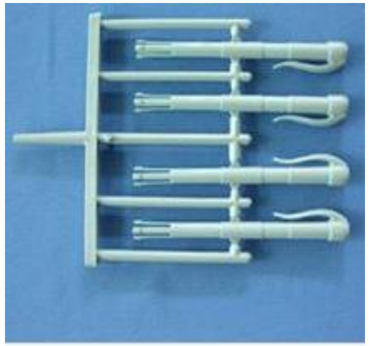
Plastics Processing: Injection Molding

- Probably the most common, most important, most economical process

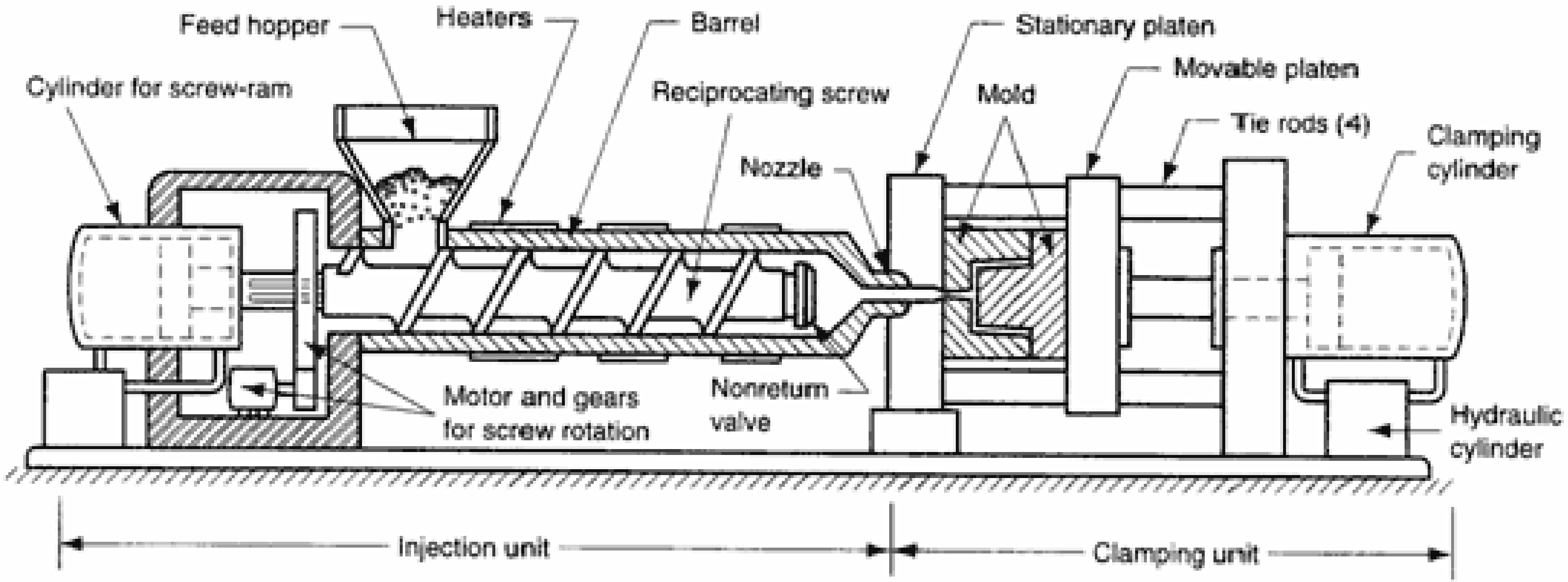
Mobile Phone

Wireless Phone

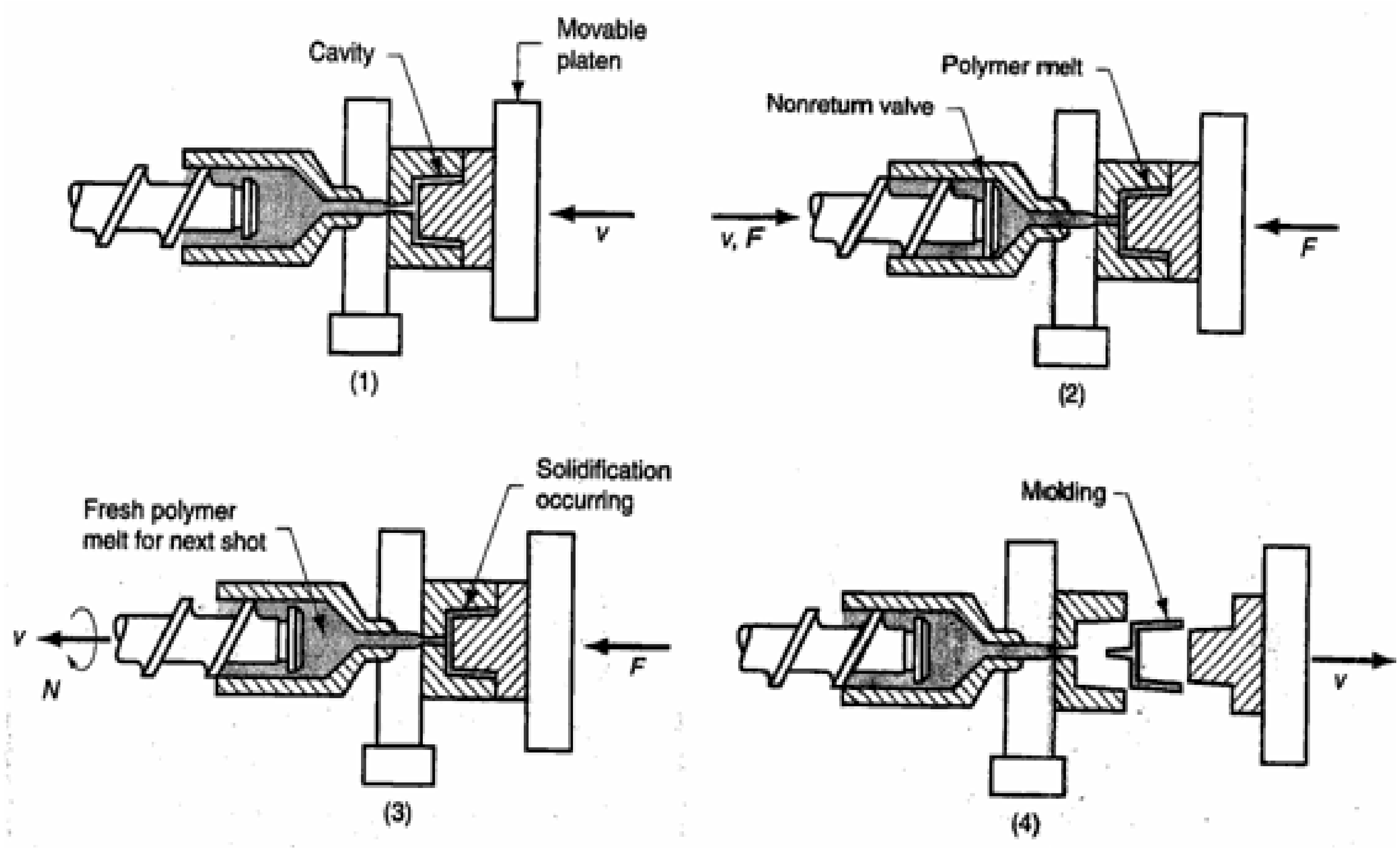
Plug



Rubber Pen



Plastics Processing: Injection Molding



Cycle of operation for injection molding

Blow Moulding

Blow Moulding

List Of Experiments

I. METAL CASTING :

1. Pattern Design and Making- by Casting Drawing
2. Sand Properties Testing- for testing strength and permeability
3. Moulding , Melting & Casting

II. WELDING:

1. Arc Welding: Lap & Butt Joints
2. Spot Welding
3. TIG Welding
4. MIG Welding
5. Brazing

III. MECHANICAL PRESS WORKING

1. Bending Operation
2. Blanking & Piercing

IV PROCESSING OF PLASTICS

1. Injection Moulding

Thank you!

9. Vehicle Maintenance & Testing Laboratory

VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad – 500 090

Department of Automobile Engineering
Lab Protocol

Vehicle Maintenance & Testing Laboratory
IV B.Tech., I Semester, Automobile Engineering

Faculty Members

Dr. Shaik Amjad
Professor

Mr. Venkata Ramarao
Assistant Professor

Course Objectives

- To provide hands on training on vehicle inspection

- To demonstrate wheel balancing and alignment tests

- To conduct vehicle pollution tests

- To diagnose and troubleshoot the vehicle using suitable test equipment

Course Outcomes

After completion of the course the student is able to

- Inspect vehicle and test engine subsystems
- Perform wheel balancing and alignment tests
- Execute vehicle emission tests
- Diagnosis and troubleshoot the vehicle

Purpose of VMT Laboratory

- All vehicles are subject to wear and tear and unless maintained at regular intervals.
- This wear and tear will eventually result in unsafe vehicles and vehicle breakdowns.
- Regular planned maintenance is a critical step in preventing this.
- Effective vehicle maintenance practices result in a vehicle that is safe and fit for.

List of experiments

Vehicle inspection

Engine compression test

Engine manifold vacuum test

Automotive battery test

Multi car scanning

Petrol vehicle exhaust analysis

Diesel Smoke Measurement

Wheel balancing of wheel and tyre assembly

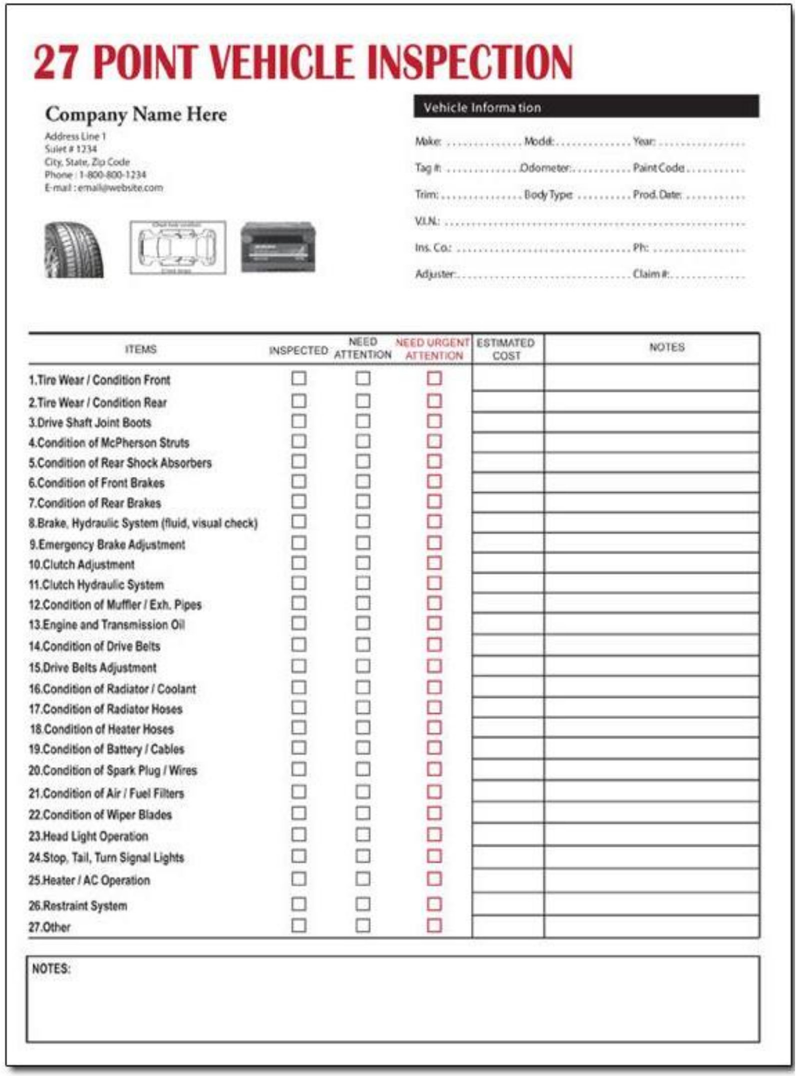
Wheel alignment test

Headlight alignment test

Ignition timing test

Vehicle inspection

Vehicle overall inspection is carried out to find the faults



27 POINT VEHICLE INSPECTION

Company Name Here

Address Line 1
Suiet # 1234
City, State, Zip Code
Phone : 1-800-800-1234
E-mail : email@website.com

Vehicle Informa tion

Make: .... Model: .... Year: ....
Tag #: .... Odometer: .... Paint Code ....
Trim: .... Body Type .... Prod. Date: ....
V.I.N.: ....
Ins. Co.: .... Ph: ....
Adjuster: .... Claim #: ....

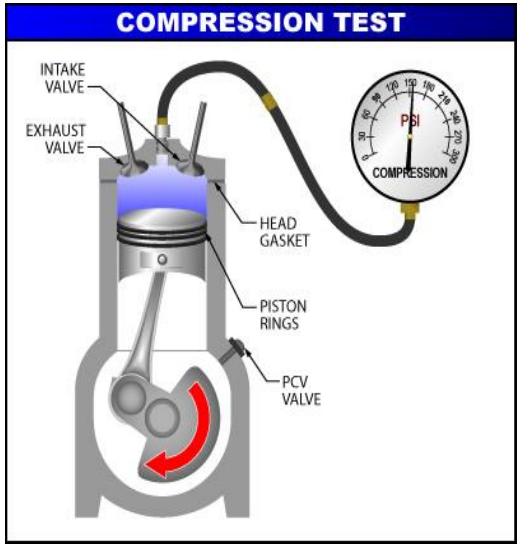
ITEMS	INSPECTED	NEED ATTENTION	NEED URGENT ATTENTION	ESTIMATED COST	NOTES
1.Tire Wear / Condition Front	☐	☐	☐		
2.Tire Wear / Condition Rear	☐	☐	☐		
3.Drive Shaft Joint Boots	☐	☐	☐		
4.Condition of McPherson Struts	☐	☐	☐		
5.Condition of Rear Shock Absorbers	☐	☐	☐		
6.Condition of Front Brakes	☐	☐	☐		
7.Condition of Rear Brakes	☐	☐	☐		
8.Brake, Hydraulic System (fluid, visual check)	☐	☐	☐		
9.Emergency Brake Adjustment	☐	☐	☐		
10.Clutch Adjustment	☐	☐	☐		
11.Clutch Hydraulic System	☐	☐	☐		
12.Condition of Muffler / Exh. Pipes	☐	☐	☐		
13.Engine and Transmission Oil	☐	☐	☐		
14.Condition of Drive Belts	☐	☐	☐		
15.Drive Belts Adjustment	☐	☐	☐		
16.Condition of Radiator / Coolant	☐	☐	☐		
17.Condition of Radiator Hoses	☐	☐	☐		
18.Condition of Heater Hoses	☐	☐	☐		
19.Condition of Battery / Cables	☐	☐	☐		
20.Condition of Spark Plug / Wires	☐	☐	☐		
21.Condition of Air / Fuel Filters	☐	☐	☐		
22.Condition of Wiper Blades	☐	☐	☐		
23.Head Light Operation	☐	☐	☐		
24.Stop, Tail, Turn Signal Lights	☐	☐	☐		
25.Heater / AC Operation	☐	☐	☐		
26.Restraint System	☐	☐	☐		
27.Other	☐	☐	☐		

NOTES:

Engine compression test

Engine compression test is carried out to determine the condition of the engine valves and piston rings

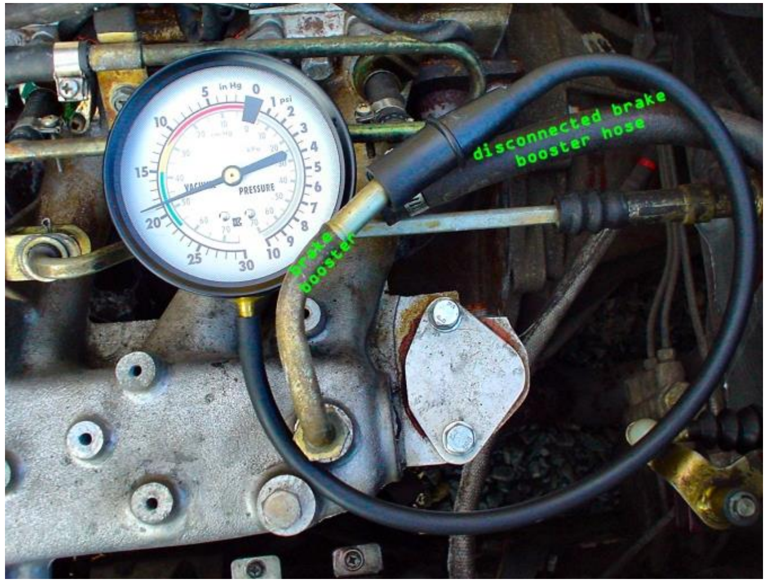
Direct Compression Test Record Card					
	Cylinder Number 1	Cylinder Number 2	Cylinder Number 3	Cylinder Number 4	Remarks
Dry Test Compression					
Wet Test Compression					
Difference in Readings					
Date of Tests					
Mileage					

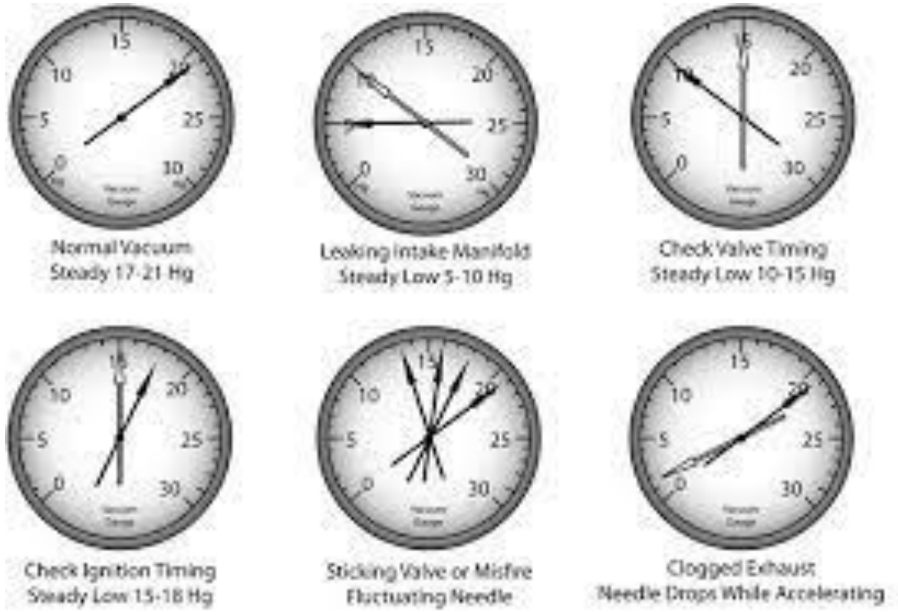


Engine manifold vacuum test

Monitoring the engine's deepest breaths can tell a lot about its health

Engine manifold vacuum test is carried out to gain insight into the symptoms of vacuum leaks, incorrect timing, low compression, sticking valves and more.

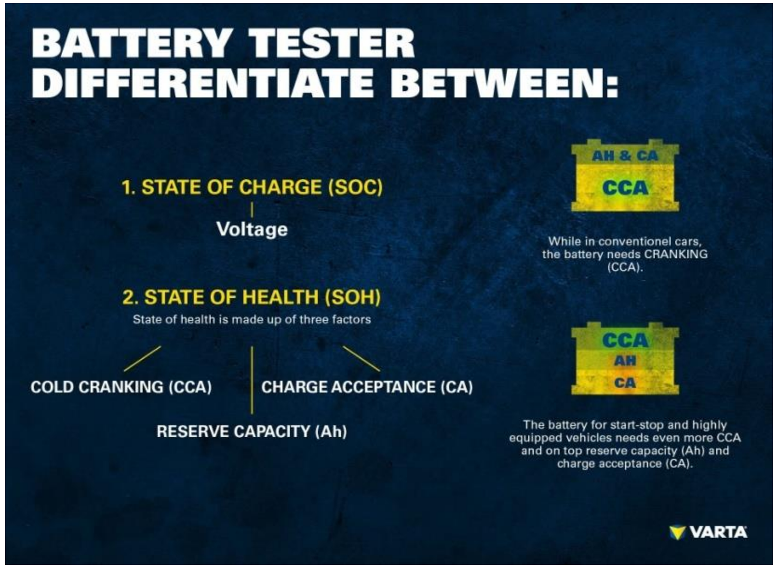


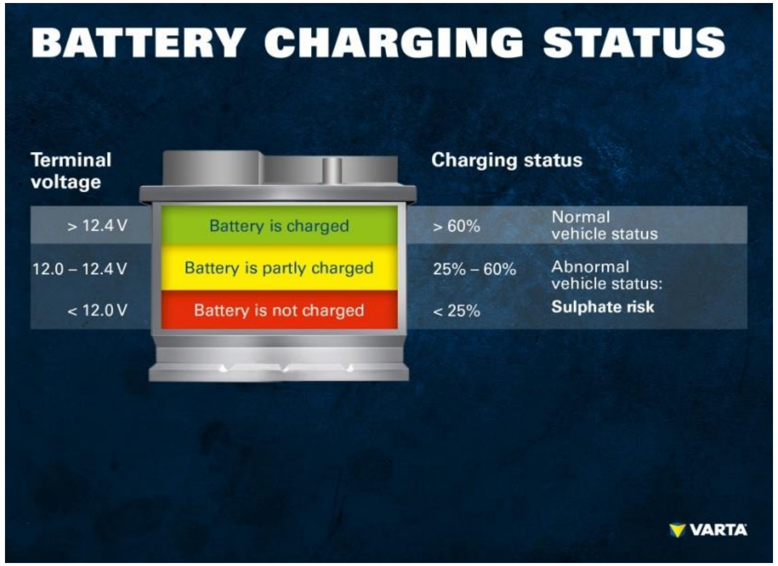


If the engine is operating under light or no load and low or closed throttle, there is high manifold vacuum.
If the engine is operating under heavy load at wide throttle openings (such as accelerating from a stop or pulling the car up a hill) then engine speed is limited by the load and minimal vacuum will be created.

Automotive battery test

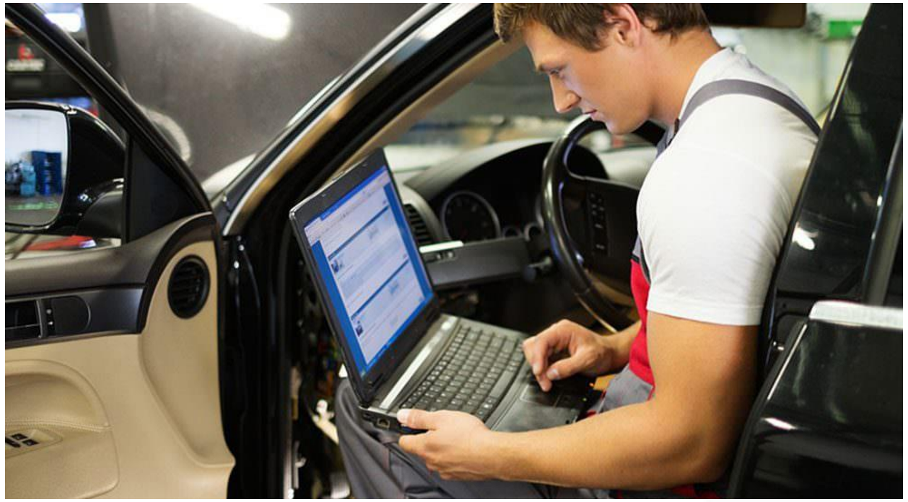
Battery test can be performed in a vehicle to test the charge

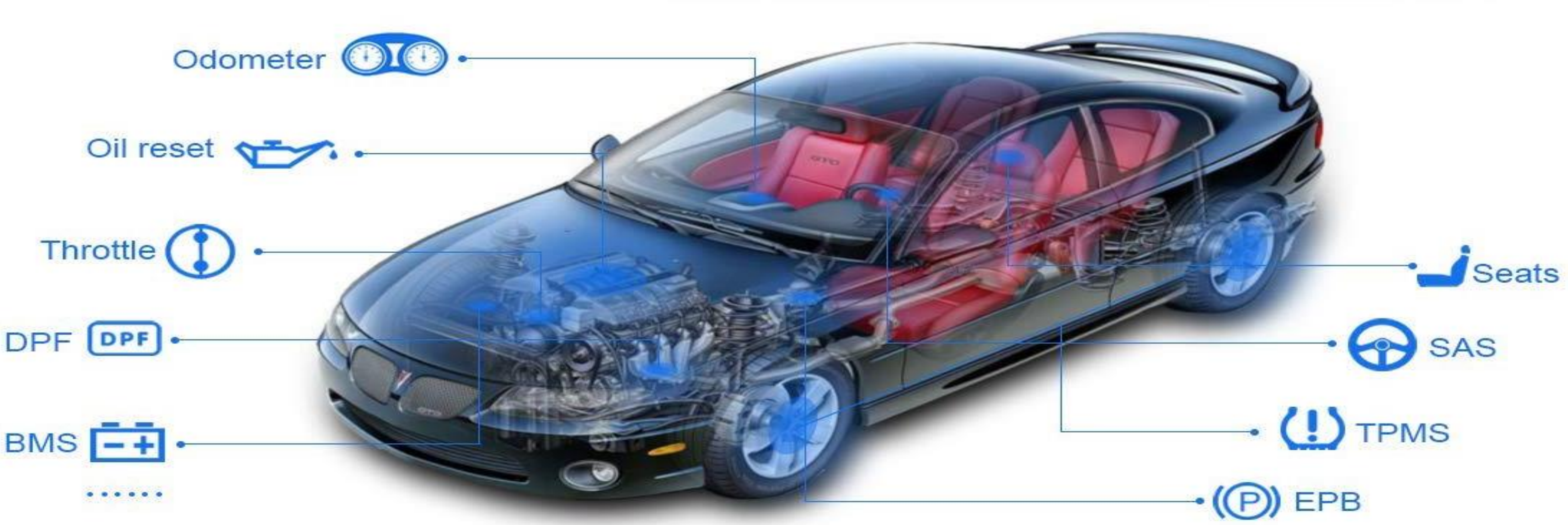




Multi car scanning

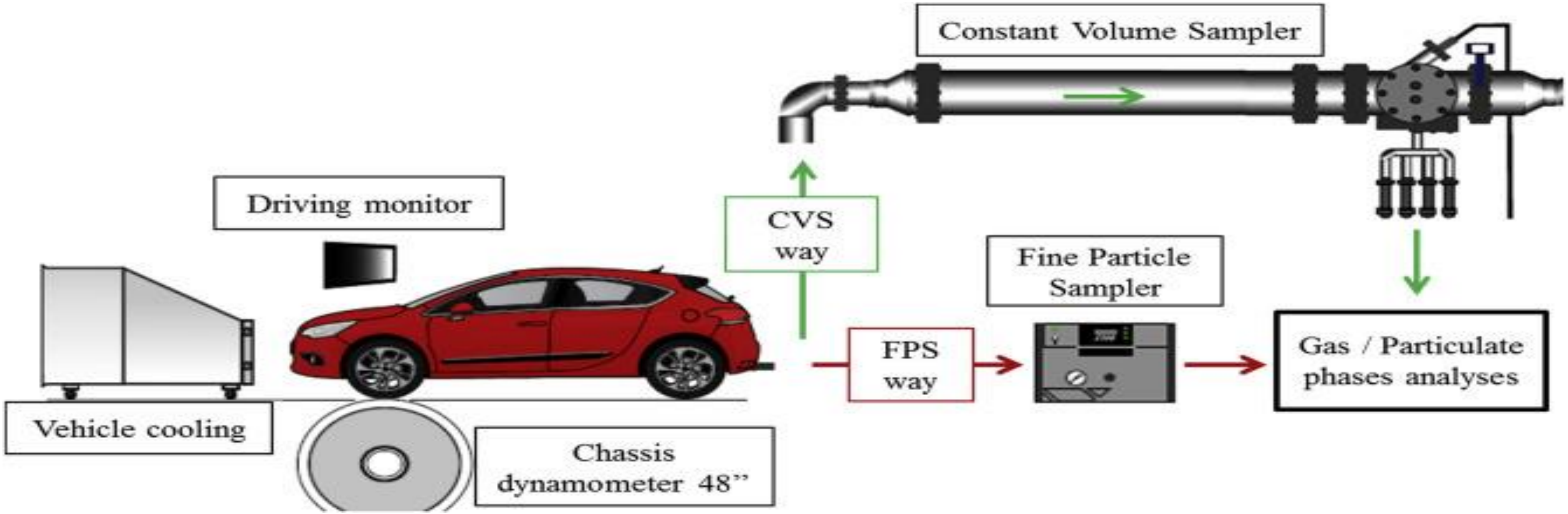
Car scanning is carried out to find error memory, and to display actual values.

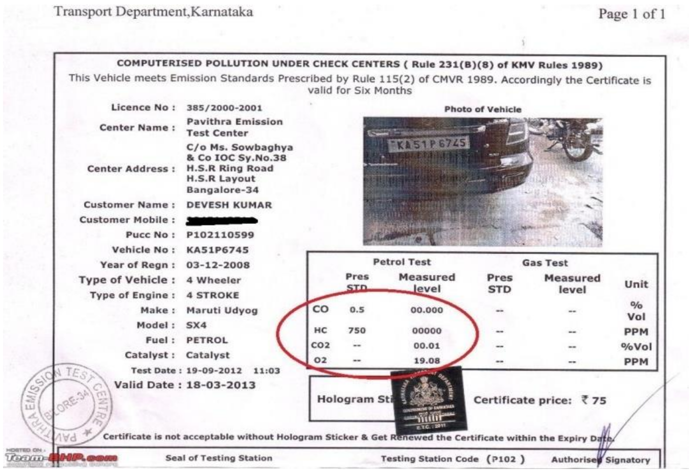




Petrol vehicle exhaust analysis

Exhaust analysis is carried out to measure and analyze the emissions of a petrol engine/vehicle.





Transport Department,Karnataka

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COMPUTERISED POLLUTION UNDER CHECK CENTERS (Rule 231(B)(8) of KMV Rules 1989)

This Vehicle meets Emission Standards Prescribed by Rule 115(2) of CMVR 1989. Accordingly the Certificate is valid for Six Months

Licence No : 385/2000-2001
Center Name : Pavithra Emission Test Center
Center Address : C/o Ms. Sowbaghya & Co IOC Sy.No.38 H.S.R Ring Road H.S.R Layout Bangalore-34
Customer Name : DEVESH KUMAR
Customer Mobile : [redacted]
Pucc No : P102110599
Vehicle No : KA51P6745
Year of Regn : 03-12-2008
Type of Vehicle : 4 Wheeler
Type of Engine : 4 STROKE
Make : Maruti Udyog
Model : SX4
Fuel : PETROL
Catalyst : Catalyst
Test Date : 19-09-2012 11:03
Valid Date : 18-03-2013

Photo of Vehicle

	Petrol Test		Gas Test		
	Pres STD	Measured level	Pres STD	Measured level	Unit
CO	0.5	00.000	--	--	% Vol
HC	750	00000	--	--	PPM
CO2	--	00.01	--	--	%Vol
O2	--	19.08	--	--	PPM

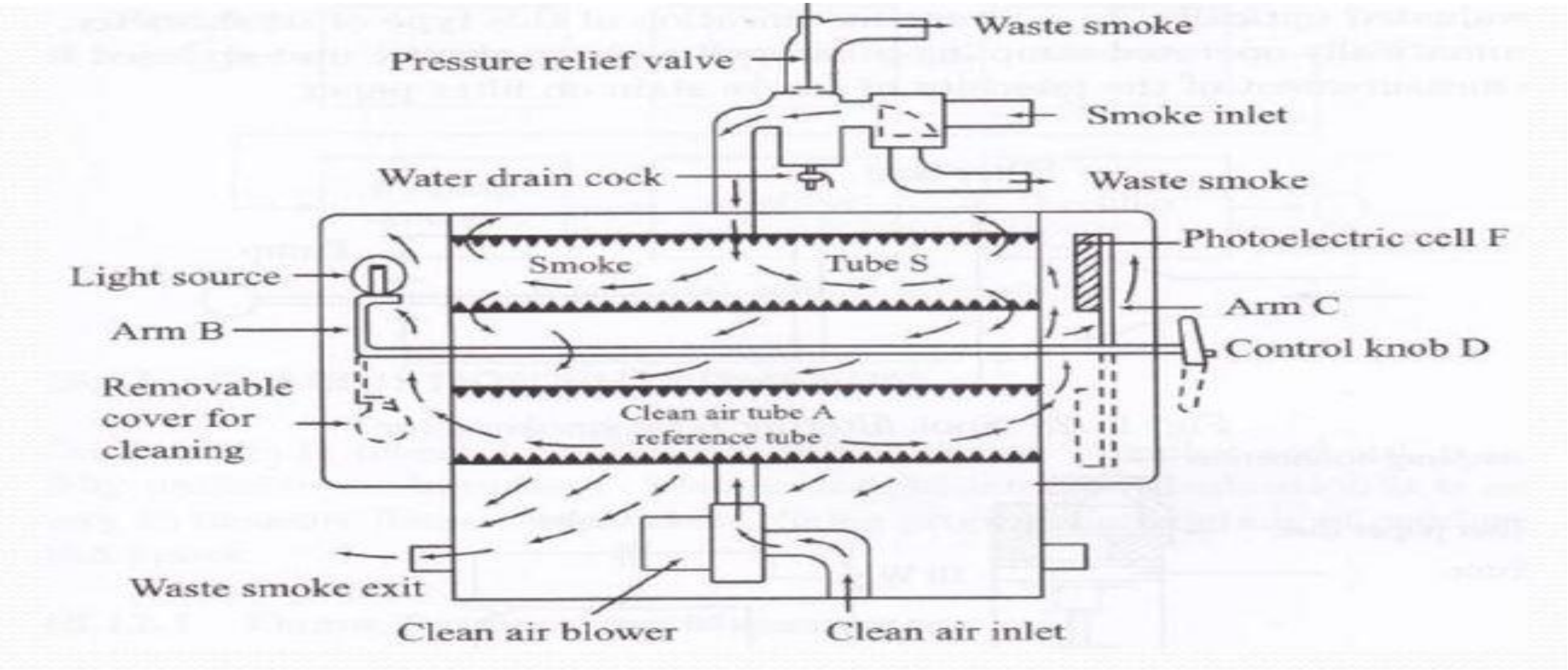
Hologram Sti[...] Certificate price: ₹ 75

Certificate is not acceptable without Hologram Sticker & Get Renewed the Certificate within the Expiry Date.

Seal of Testing Station | Testing Station Code (P102) | Authorised Signatory

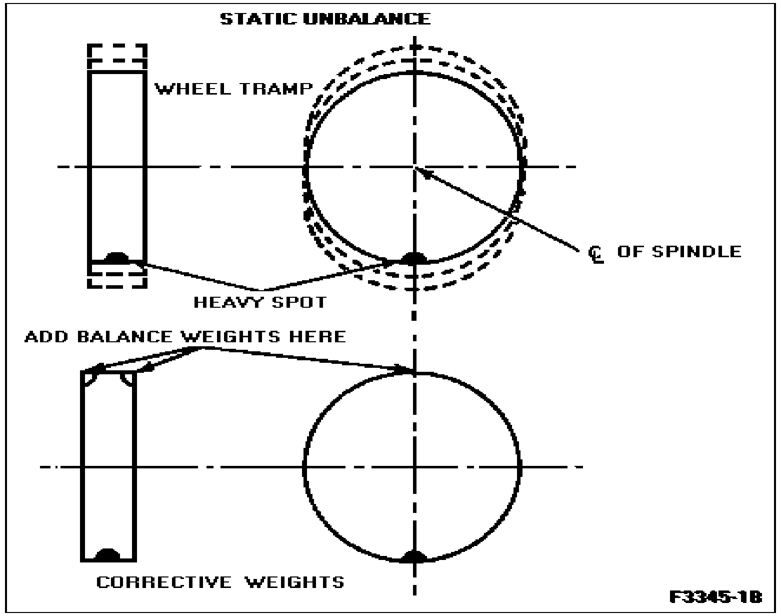
Diesel smoke measurement

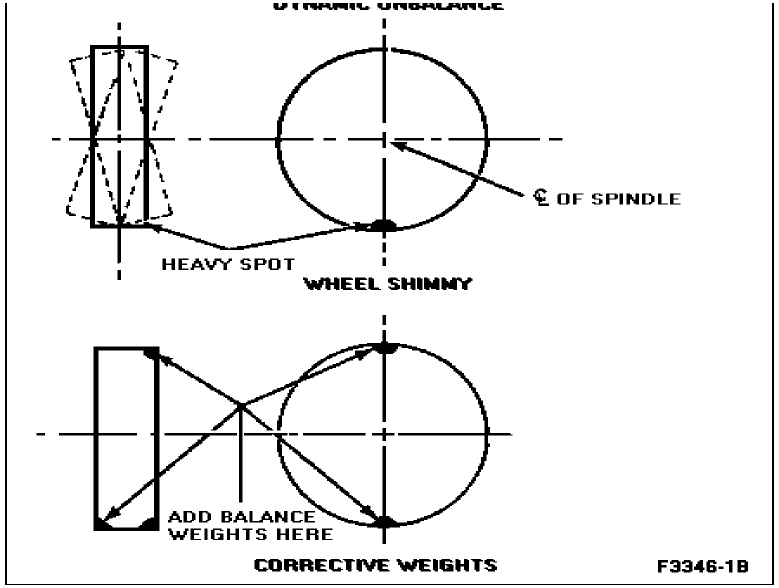
To measure the smoke emitting from a diesel engine/vehicle



Wheel balancing of wheel and tyre assembly

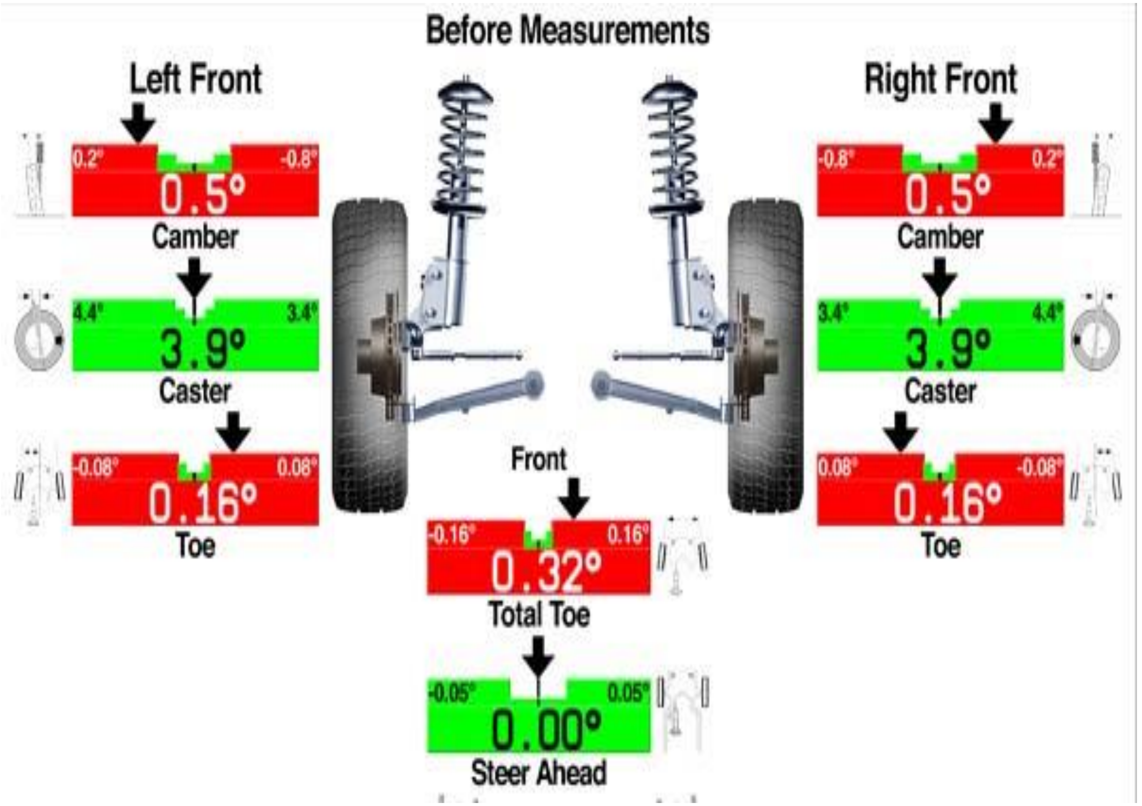
conduct the wheel balancing test on the given wheel and tyre assembly.





Wheel alignment test

Wheel alignment test is carried out to find the castor angle, total toe and camber for a given vehicle.



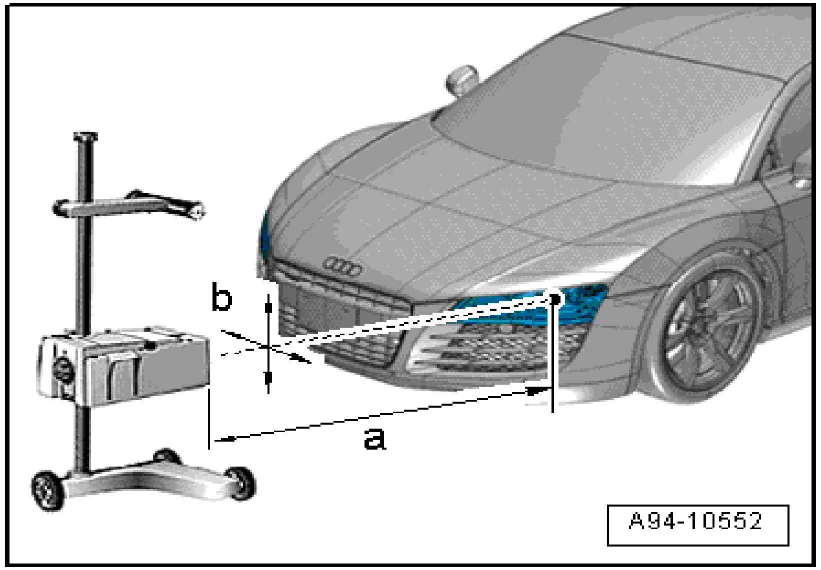
Applications

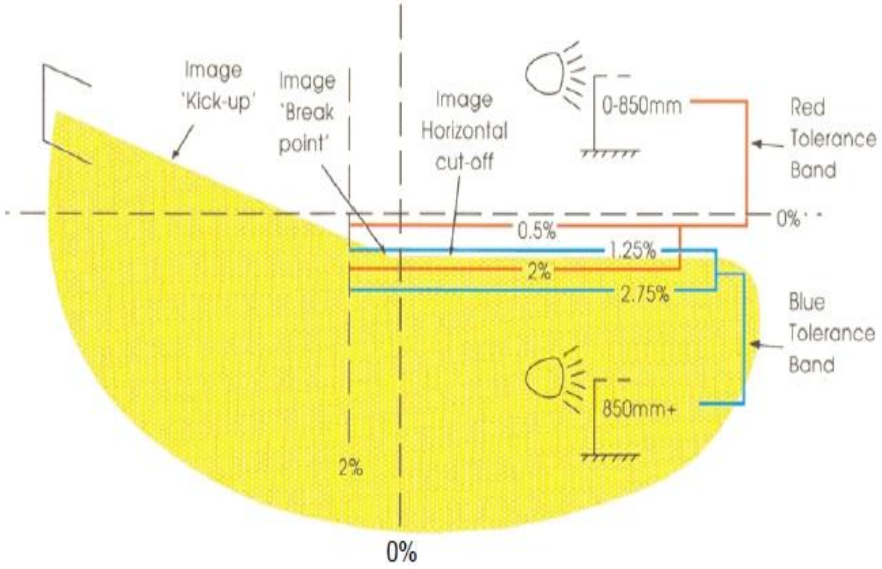
Car drifts to one side due to the misalignment of the wheel angle, to rectify this wheel alignment test should be performed

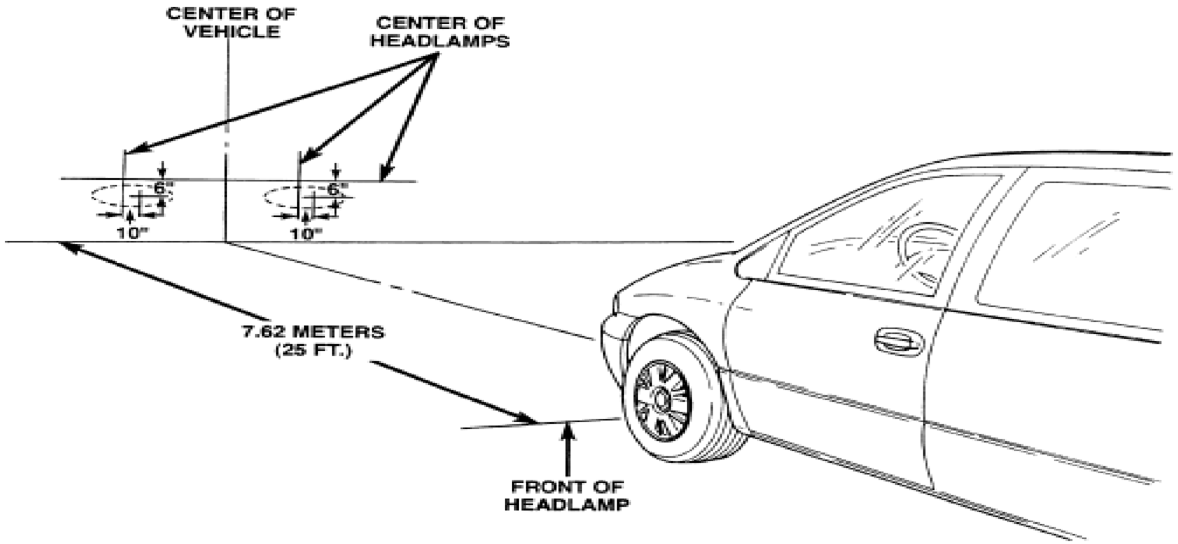
Tire tread wear causes the distribution of weight around the tire to change. This leads to an imbalance that causes the vehicle to shake or vibrate. Wheel balancing test can be performed to balance the imbalance weight.

Headlight alignment test

Headlight alignment test is carried out to adjust the headlight

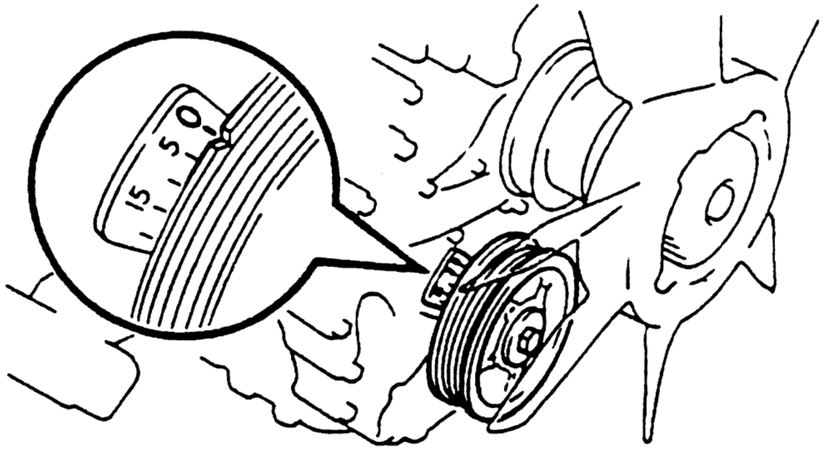


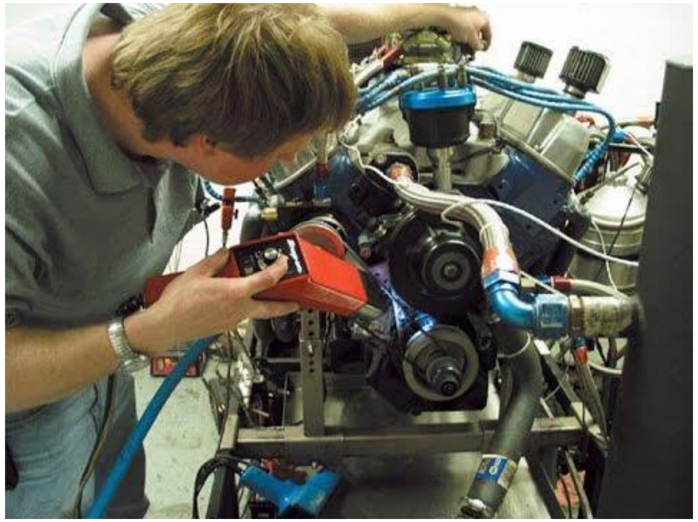


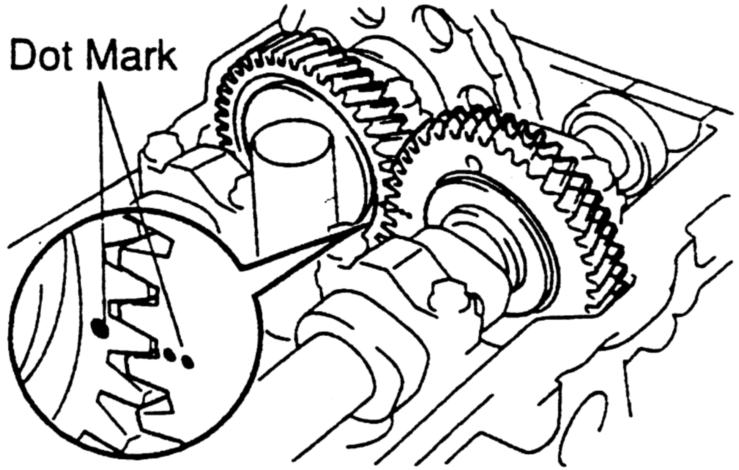


Ignition timing test

Ignition timing test is carried out to check the correct position of the ignition timing







Cycle -I

Vehicle Inspection

Engine compression test

Engine Manifold Vacuum test

Automotive battery test

Wheel balancing of wheel and tyre assembly

Cycle -II

Petrol Vehicle exhaust analysis

Diesel Smoke Measurement

Wheel alignment test

Headlight alignment test

Ignition timing test

Multi car scanning

LABORATORY SAFETY RULES

- Keep yourself and others safe.
- Wear appropriate safety equipment.
- No loose clothes and long hair around machines.
- Clean up any spills immediately.
- Wear shoes to protect the feet from falling weights.
- Don’t play with machines/tools.

- Maintain discipline and be regular to the laboratory
- Carry the observation book and record to the laboratory
- Follow proper dress code in the laboratory
- Do not use any equipment unless you are trained
- Wear safety glasses or face shields when working with hazardous materials and/or equipment
- If you have long hair or loose clothes, make sure it is tied back or confined
- Keep the work area clear of all materials except those needed for your work
- Extra books, purses, etc. should be kept away from equipment
- Students are responsible for the proper disposal of used material if any in appropriate containers

- Wear shoes to protect your feet
- Check all electrical connections and mounting bolts before each use
- Check that all rotating parts are free to turn, and that there is no mechanical obstruction before operating
- If an equipment fails while being used, report it immediately to your lab assistant or in-charge
- Never try to fix the problem yourself because you could harm yourself and others
- Exercise care when working with or near hydraulically- or pneumatically-driven equipment. Sudden or unexpected motion can inflict serious injury
- If leaving a lab unattended, turn off all ignition sources
- Clean up your work area before leaving
- Wash hands before leaving the lab and before eating

Common Sense

Good common sense is needed for safety in a laboratory. It is expected that each student will work in a responsible manner and exercise good judgement and common sense. If at any time you are not sure how to handle a particular situation, ask your Lab in-charge or Instructor for advice. It is always better to ask questions than to risk harm to yourself or damage to the equipment. Do not touch anything with which you are not completely familiar.

Feedback form: https://forms.gle/icuShPrvJtKFrWtT9

For more details contact: aehead@vnrvjiet.in


THANK YOU